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ABSTRACT

This document is a resource for information on distance education research in Iowa. The material is divided into three sections. The first section describes distance education in Iowa, the Iowa Communications Network (ICN), the Iowa Distance Education Alliance (IDEA), and the research plan underway. The second section contains a review of the literature on distance education, including the definition, history and theory of distance education, research, operational issues, and a selected bibliography. In the third section, research project results are discussed. Highlights include teacher training and the effects of technology, interactive television, assessing learning needs and course performance, music, foreign language, and science instruction using telecommunications technology, teacher development, use of the ICN for secondary agriculture programs and instrumental music instruction, demographics and innovation of the community college, student and teacher perceptions of effective instructional methods, and teacher attitudes. (AEF)

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Encyclopedia of Distance Education Research in Iowa

Editors: Michael R. Simonson, Professor and Associate Director
Charles Schlosser and Mary Anderson, Research Assistants
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College of Education, Iowa State University

A publication of the Teacher Education Alliance of the Iowa Distance Education Alliance, Iowa's Star Schools Project. This project was funded in part by U.S. Department of Education Star Schools Grant #R203 B 20001-93

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SECTION I - A RESEARCH PLAN

Overview of the Teacher Education Alliance, Iowa Distance Education Alliance Research Plan

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Two significant events are underway in Iowa. First, the Iowa Communications Network (ICN), a statewide, full-motion interactive fiber optic network, is in use. The ICN is a 2800 mile system that connects sites in each of Iowa's 99 counties with a fiber optics network for distance education. The ICN is being built entirely with state funds and is designed to enhance the educational opportunities available to students from Iowa's schools.

Second, a group of Iowa educational organizations prepared a proposal titled the Iowa Distance Education Alliance (IDEA), and in October 1992 received notification of funding from the U. S. Department of Education's Star Schools Program. The IDEA's primary purpose is to infuse distance education into the schools and colleges of Iowa.

One component of the IDEA was to begin a comprehensive research plan that investigated the use of the ICN and the activities of the IDEA. During 1993, research studies were started. They were based on Rogers' (1983) Diffusion of Innovations Theory, and provided a foundation for additional studies to be conducted in the future.

Few innovations have the potential impact that the ICN may have on Iowa education. The research plan of the IDEA will empirically examine the infusion of the innovation, "a statewide, full-motion interactive fiber optic network," and will provide information about the large scale adoption of distance education by an entire state.

Purpose

This section describes distance education in Iowa, the ICN, the IDEA, and the research plan underway in Iowa. Research and evaluation are central to the implementation of distance education in Iowa. The process used to rally educators to conduct research is explained.

Distance Education in Iowa: Background

Iowa's approach to distance education is based on the belief that live, interactive instruction is fundamental to effective learning. Interaction is made possible by the ICN. The ICN is a statewide two-way full motion interactive fiber optic telecommunications network. It is designed to be used by teachers and students in learning situations where they not only can see and hear each other, but where they expect to see and hear each other. Distant and local students function together as a learning group. They learn from and with one another.

Key to Iowa's successful distance education system is the concept of sharing. Iowa's vision for distance education is being built around the development of partnerships of schools that share courses. For example, a physics class originating in Jefferson may have students in Sac City and Rockwell City, schools in two adjacent counties. French students in Sac City have distant classmates in Jefferson and Rockwell City, and a calculus class that originates in Rockwell City is shared with students in Sac City and Jefferson. All three schools provide courses to partner schools and receive instruction from neighbors. Classes are small with enrollments of 30-35 or less, and are taught by teachers prepared in the skills needed by distance educators.

Iowa's approach to distance education is based on several beliefs about education. The United States has historically been perceived as having the finest education system ever developed. Local control, small classes, rapport between teachers and students, and highly personalized instruction are hailed as important characteristics of this respected system. On the other hand, telecommunications-based education is often perceived as the antithesis to these attributes. Distance education and telecommunications create the image of a centralized curriculum, a single source of information, and large classes with little or no interaction between the teacher and students. Some feel that the traditional values of education and increased use of technology are incompatible with one another. Iowa educators are attempting to prove these critics wrong.

Of the many projects of the last few years that have promoted the use of technology, few have been as successful as the US Department of Education's Star Schools Program. The Star Schools Program began in 1987 "to encourage improved instruction in mathematics, science, foreign languages, literacy skills, and vocational education for underserved populations through the use of telecommunications networks." Many star schools projects have used communications satellites to deliver courses to large numbers of students located in dozens of cities and states. In 1992, a new approach to distance education was recognized by the Star Schools Program when a proposal submitted by an alliance of educational organizations in the state of Iowa was funded.

Iowa's project demonstrates a distance education system that uses a statewide two-way full motion interactive fiber optic telecommunications network. The "Iowa Distance Education Alliance: Partnerships for Interactive Learning Through Telecommunications (IDEA)," the name of Iowa's Star Schools project, demonstrates that historically important characteristics of an effective educational environment can be combined with educational technology to bring the best of both to the student faced with the challenge of being a citizen of the 21st century. The use of fiber optic technology, because of its extensive capacities and flexibility, provides unique opportunities for augmenting the instructional process beyond what is possible using other distance delivery technologies. The IDEA demonstrates the use of a system that emphasizes:

- local control of the curriculum,
- active involvement by educators from local school districts,
- interactive instruction,
- statewide alliances and regional partnerships,
- preservice, inservice, and staff development activities,
- implementation using existing organizations and expertise, and
- research-based instructional decision making.

Definition and Theory

During the development of the research plan of the IDEA, it became obvious that Iowans were reinventing (Rogers, 1983) distance education. A tentative definition of the theoretical approach for the study of distance education emerged. These statements were used as guides for both the study and practice of distance education in Iowa. Distance education was defined as formal, institutionally-based educational activities where the teacher and learner are normally separated from each other in location but not normally separated in time, and where two-way, full motion interactive telecommunications systems are used to connect them for the sharing of video, data, and voice-based instruction.

Iowa researchers went on to propose a theoretical approach for the practice of distance education.

> The more similar the learning experience of the distant student is to that of the local student, the more similar will be the outcomes of the learning experience.

The Iowa Communications Network (ICN)

Central to the successful completion of the IDEA project is the ICN (see Figure 1). The ICN is a statewide two-way full motion interactive fiber-optic telecommunications network with at least one point of presence in each of Iowa's 99 counties. The ICN links colleges, universities and secondary schools throughout the state and was constructed entirely with state and local funds.

The plan for the ICN was completed and adopted by the Iowa legislature in 1987. Construction of the fiber optic backbone portion of the network was completed during 1993. The ICN will ultimately connect hundreds of schools, colleges, regional libraries, and governmental agencies. In addition to the capability of transmitting up to 48 simultaneous video channels, the ICN carries data and voice traffic, and as demand increases the system is easily expandable without the need for "opening the trench" to lay more fiber. The IDEA Star Schools initiative is developing and enhancing the human and technical resources necessary to make effective use of the ICN.

The Iowa Distance Education Alliance

Partnerships of Iowa educational organizations are implementing the goals and objectives of the IDEA. Partnerships in Iowa are also referred to as alliances because they are a "joining for a common purpose," which is the appropriate infusion of live, two-way interactive telecommunications into the educational systems of the state of Iowa.

The IDEA was formed as the result of a collaborative effort of teachers and administrators from local school districts, the Iowa Department of Education, Iowa Public Television (IPTV), Iowa's community colleges, area education agencies, and public (regent) and independent colleges and universities, with support from teacher and administrator professional organizations and the state's K-12 school boards. This alliance of Iowa's educational organizations is responsible for completing the IDEA project.

Educational organizations participating in the IDEA are organized into several components to ensure that the activities of the project are completed (see Figure 2). First, 15 regional partnerships, organized in accordance with Iowa's merged area education structure, were formed. The state's 15 area community colleges and 15 area education agencies which share common boundaries are collaborating with teachers and administrators from local schools to plan for staff development, inservice activities, and course offerings. Classrooms have been equipped. Teachers have been trained. Curriculum materials are under development. Staff in-service activities were offered, and beginning Fall, 1993, courses began to be shared.

Second, a clearinghouse was established by the Iowa Department of Education. The clearinghouse provides quick and comprehensive access to information about interactive telecommunications, and it coordinates access for IDEA partners to other computer and telecommunications networks, such as the Internet.

The third component of the project is the Teacher Education Alliance which is being coordinated by faculty from each of the state's three public universities working closely with teachers, teacher education faculty from the independent colleges and universities, and the area education agencies. The Teacher Education Alliance has developed a process for, and materials being used in, preservice and inservice teacher education experiences. Materials are being used to assist teachers in curriculum revision activities and to prepare them for instruction of students at a distance. Workshops have been held. Inservice sessions have been delivered, and curriculum plans for staff development are being made available. Finally, the staff of the Teacher Education Alliance developed and are completing a comprehensive plan for research and evaluation to determine the unique contributions of the Iowa approach to the theory and practice of distance education.

The fourth component of the IDEA is the project management structure which is coordinated by IPTV and the Iowa Department of Education. The project manager's primary responsibilities are to administer the activities of the project and to interact for the alliance with organizations in Iowa and elsewhere.

Goals and Activities

The project's goals are listed in Figure 3. To accomplish these goals a number of activities were undertaken. Some of the more significant activities were:

1. During 1993, each of the 104 endpoints of the ICN were connected to a fully equipped distance education classroom.

2. During 1993, a public awareness program was planned and implemented that familiarized Iowa citizens with the concept of distance education, the capabilities of the ICN, and the purposes of the IDEA.

3. The framework for sharing of distance education courses was developed.

4. Faculty from Iowa's colleges and universities collaborated to develop a curriculum implementation plan that is being used so that graduates of Iowa's teacher education programs are prepared to become distance education teachers.

5. During the Spring and Summer of 1993, hundreds of Iowa teachers were prepared to teach using the ICN.

6. Faculty from Iowa's universities and colleges collaborated with representatives from the state's area education agencies to ensure that distance education courses reflected current thinking and reform efforts in science, mathematics, foreign language, vocational education, and literacy education.

7. A comprehensive research plan based on the principles of diffusion of innovations was formulated and begun. This plan identified a number of action-research projects that dealt with local concerns in addition to studies that investigated more fundamental distance education issues.

Finally, the partners of the IDEA established the framework for the infusion of the principles and practices of distance education throughout the state. The IDEA is a model for other states and regions that plan the large scale implementation of a distance education system that is based on the concept of local control of courses offered using live two-way interactive telecommunications.

The Research Situation

Feelings in Iowa related to distance education have traditionally been volatile, and this presents the opportunity for many research studies. Specifically, the situation in Iowa is characterized by the following.

1. The ICN was planned for the educational community of Iowa by state government, most notably by the administrative branch. No consensus of acceptance was sought from or given by Iowa's educators. In other words, the ICN is a top-down innovation that was built and now is available to Iowa educators.

2. In 1993 when the project began, only a small percentage of Iowa educators and Iowa citizens clearly understood distance education and the ICN, but most were aware that the state was spending over $100 million to construct the ICN.

3. Many educators and citizens were skeptical of the concept of distance education, and opposed the construction of the ICN.

4. Distance education has gained acceptance as a discrete category of education.

5. Fiber optics communication is the most effective transmission method for live, two way, full motion interactive telecommunication, even though it is not the only effective transmission method, or the most cost effective transmission method. In Iowa, fiber optics has been mandated by the legislature as the primary medium for distance education.

6. Most teachers are not familiar with the techniques of the distant educator, or the needs of the distant learner.

7. Distance education research is emerging, is largely anecdotal, is not empirically based, and usually is reported as individual studies with little or no relationship to an ongoing, large-scale research plan.

8. Theories of distance education have been proposed and are beginning to gain acceptance.

9. Rogers' Diffusion of Innovations Theory, one of several theories that provide a foundation for research in distance education, is considered an appropriate guide for a large-scale research agenda such as the diffusion of distance education in Iowa.

The Research Plan

First, a group of Iowa educators was identified to serve as a research and evaluation advisory panel (REAP). This group developed the plan for soliciting research proposals from those interested in investigating the distance education situation in Iowa. A Request for Proposals (RFP) process was used (see Appendix 1). This RFP was sent to more than 1000 Iowa educators from a cross section of academic disciplines and organizations. The RFP process was conducted in four phases. After each phase, proposals were reviewed by the REAP who provided authors of the proposals with suggestions for improving their studies. In some cases proposals were revised and resubmitted, based on suggestions made by the REAP. At the conclusion of the RFP process, studies were selected for funding (see Appendix 2).

Next, a comprehensive review of the distance education literature was commissioned. This document (Schlosser and Anderson, 1994), was published by the Association for Educational Communications and Technology, and included current information on the theories, research, and critical issues of distance education. This monograph was distributed to the researchers whose proposals were selected for funding to assist them in their research efforts. This monograph also is used to provide consistency among the research studies. It is included in its entirety in Section II.

Late in 1993, the RFP process was concluded. Next, summaries of the funded research studies were published. This was to inform Iowa educators of the scope of the project's research plan. Finally, this Encyclopedia of Distance Education Research in Iowa was published. The Encyclopedia includes the entire research agenda of the IDEA project including:

- the research, theory, and issues monograph,
- the final reports of the project's research studies.

Conclusion

"Finally, the most fundamental and most important characteristic of a profession is that the skills involved are founded upon a body of intellectual theory and research. Furthermore, this systematic theory is constantly being expanded by research and thinking within the profession . . . the practice of a profession cannot be disjoined from its theoretical understanding and vice versa . . . The antithesis to a profession is an avocation based upon customary activities and modified by the trial and error of individual practice. Such an avocation is a craft. . . The difference between the bricklayer and the architect lies right here." (Finn, 1953, p. 9.)

In Iowa, every attempt is being made to insure that the practice of distance education is based on theory supported by research. The results of the research plan described above will support the professionalization of distance education in Iowa, and nationwide.

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SECTION II - DISTANCE EDUCATION - REVIEW OF THE LITERATURE

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Distance Education--Definition, History and Theory

What is Distance Education?

It is the nature of questions that they are easier to ask than to answer. This is true of the question, "what is distance education?" for at least two main reasons. First, "distance" has multiple meanings. Second, the term, "distance education," has been applied to a tremendous variety of programs serving numerous audiences via a wide variety of media.

To Rudolf Manfred Delling,

> Distance education (Fernunterricht) is a planned and systematic activity which comprises the choice, didactic preparation and presentation of teaching materials as well as the supervision and support of student learning and which is achieved by bridging the physical distance between student and teacher by means of at least one appropriate technical medium (in Keegan, 1986, p. 58).

For Hilary Perraton, (1988) distance education is "an educational process in which a significant proportion of the teaching is conducted by someone removed in space and/or time from the learner" (p. 34).

The U.S. Department of Education's Office of Educational Research and Improvement (in Bruder, 1989) defines distance education as "the application of telecommunications and electronic devices which enable students and learners to receive instruction that originates from some distant location" (p. 30). Typically, the learner is given the capacity to interact with the instructor or program directly, and given the opportunity to meet with the instructor on a periodic basis.

Greville Rumble (1989) offered the following five-part definition of distance education:

- In any distance education process there must be: a teacher; one or more students; a course or curriculum that the teacher is capable of teaching and the student is trying to learn; and a contract, implicit or explicit, between the student and the teacher or the institution employing the teacher, which acknowledges their respective teaching-learning roles.
- Distance education is a method of education in which the learner is physically separate from the teacher. It may be used on its own, or in conjunction with other forms of education, including face-to-face.
- In distance education learners are physically separated from the institution that sponsors the instruction.
- The teaching/learning contract requires that the student be taught, assessed, given guidance and, where appropriate, prepared for examinations that may or may not be conducted by the institution. This must be accomplished by two-way communication. Learning may be undertaken either individually or in groups; in either case it is accomplished in the physical absence of the teacher (p. 19).

For Desmond Keegan, (1988a) the following four definitions were central to an attempt to identify the elements of a single, unifying definition of distance education:

1. The French government, as part of a law passed in 1971, defined distance education as
   ...education which either does not imply the physical presence of the teacher appointed to dispense it in the place where it is received or in which the teacher is present only on occasion or for selected tasks. (p. 6)
2. Börje Holmberg noted that distance education
   ...covers the various forms of study at all levels which are not under the continuous, immediate supervision of tutors present with their students in lecture rooms or on the same premises but which, nevertheless, benefit from the planning, guidance and teaching of a supporting organization. (p. 6)
3. In defining distance education, Otto Peters emphasized the role of technology:
   Distance teaching/education (Fernunterricht) is a method of imparting knowledge, skills and attitudes which is rationalized by the application of division of labor and organizational principles as well as by the extensive use of technical media, especially for the purpose of reproducing high quality teaching material which makes it possible to instruct great numbers of

> students at the same time wherever they live. It is an industrialized form of teaching and learning. (p. 6)

4. For Michael Moore, the related concept of "distance teaching" was defined as

> ...the family of instructional methods in which the teaching behaviors are executed apart from the learning behaviors, including those that in a contiguous situation would be performed in the learner's presence, so that communication between the teacher and the learner must be facilitated by print, electronic, mechanical or other devices. (p. 6)

Keegan (1988a) identified six main elements of these definitions, using them to compose a definition of distance education:

- the separation of teacher and learner, which distinguishes it from face-to-face lecturing
- the influence of an educational organization, which distinguishes it from private study
- the use of technical media, usually print, to unite teacher and learner and carry the educational content
- the provision of two-way communication, so that the student may benefit from or even initiate dialogue
- the possibility of occasional meetings for both didactic and socialization purposes
- the participation in an industrialized form of education which, if accepted, contains the genus of radical separation of distance education from other forms. (p. 30)

Garrison and Shale (1987) argued that, in light of advances in distance education delivery technologies, Keegan's definition was too narrow, and did not "correspond to the existing reality as well as to future possibilities" (p. 13). While declining to offer a definition of distance education, Garrison and Shale offered the following three criteria they regarded as "essential for characterizing the distance education process" (p. 11):

1. Distance education implies that the majority of educational communication between (among) teacher and student(s) occurs noncontiguously.

2. Distance education must involve two-way communication between (among) teacher and student(s) for the purpose of facilitating and supporting the educational process.

3. Distance education uses technology to mediate the necessary two-way communication. (p. 11)

The History of Distance Education

The roots of distance education are at least 150 years old. An advertisement in a Swedish newspaper in 1833 touted the opportunity to study "Composition through the medium of the Post" (Holmberg, 1986, p. 6).

In 1840, England's newly-established penny post allowed Isaac Pitman to offer shorthand instruction via correspondence. Three years later, instruction was formalized with the founding of the Phonographic Correspondence Society, precursor of Sir Isaac Pitman Correspondence Colleges (Holmberg, 1986).

Distance education, in the form of correspondence study, was established in Germany by Charles Toussaint and Gustav Langenscheidt, who taught language in Berlin. Correspondence study crossed the Atlantic in 1873, with the founding, by Anna Eliot Ticknor, of a Boston-based society to encourage study at home. The Society to Encourage Studies at Home attracted more than 10,000 students in 24 years (Watkins, 1991). Students of the classical curriculum (mostly women) corresponded monthly with teachers, who offered guided readings and frequent tests.

From 1883-1891, academic degrees were authorized by the state of New York through the Chautauqua College of Liberal Arts to students who completed the required summer institutes and correspondence courses. William Rainey Harper, the Yale professor who headed the program, was effusive in his support of correspondence study, and confident in the future viability of the new educational form:

> The student who has prepared a certain number of lessons in the correspondence school knows more of the subject treated in those lessons, and knows it better, than the student who has covered the same ground in the classroom.
>
> The day is coming when the work done by correspondence will be greater in amount than that done in the class-rooms of our academics and colleges;

> when the students who shall recite by correspondence will far outnumber those who make oral recitations. (Watkins, p. 4)

In 1891, Thomas J. Foster, editor of *The Mining Herald*, a daily newspaper in eastern Pennsylvania, began offering a correspondence course in mining and the prevention of mine accidents. His business developed into the International Correspondence Schools, a commercial school whose enrollment exploded in the first two decades of the century, from 225,000 in 1900 to more than 2,000,000 in 1920 (Rose, 1991).

In 1886, H. S. Hermod, of Sweden, began teaching English by correspondence. In 1898 he founded Hermod's, which would become one of the world's largest and most influential distance-teaching organizations (Holmberg, 1986).

Correspondence study continued to develop in Britain with the founding of a number of correspondence institutions, such as Skerry's College, in Edinburgh, in 1878, and University Correspondence College, in London, in 1887. At the same time, the university extension movement in the United States and England promoted the correspondence method. Among the pioneers in the field were Illinois Wesleyan, in 1877, and the University Extension Department of the University of Chicago, in 1892 (Holmberg, 1986).

Illinois Wesleyan offered bachelor's, master's and doctoral degrees as part of a program modeled on the Oxford, Cambridge, and London model. Between 1881 and 1890, 750 students were enrolled, and in 1900, there were nearly 500 students seeking degrees. However, concerns about the quality of the program prompted a recommendation that it be terminated by 1906 (Watkins).

Correspondence study was integral to the University of Chicago. The school, founded in 1890 and opened two years later, had as one of its five divisions University Extension, the first such division in an American university. The extension division was divided into five departments: lecture study, class study, correspondence teaching, library, and training (Watkins).

The correspondence study department of the University of Chicago was successful, at least in terms of numbers. Each year, 125 instructors taught 3,000 students enrolled in 350 courses. Nevertheless, enthusiasm within the university for the program waned, partly for financial reasons (Watkins).

At the University of Wisconsin, the development of the "short course" and farmers' institutes in 1885 formed the foundation for university extension. Six years later, the university announced a program of correspondence study led by the eminent historian, Frederick Jackson Turner. However, as at the University of Chicago, faculty interest waned. Further, public response was minimal, and the correspondence study program was discontinued in 1899 (Watkins). Correspondence study would have to wait another seven years to be reborn under a new, stronger, Correspondence Study Department within the school's University Extension Division.

Distance education began to enrich the secondary school curriculum in the 1920s. Benton Harbor, Michigan students were offered vocational courses in 1923, and six years later, the University of Nebraska began experimenting with correspondence courses in high schools (Holmberg, 1986).

In France, the Ministry of Education set up a government correspondence college, in response to the impending war. Although the Centre National d'Eseignment par Correspondences was established for the education of children, it has since become a huge distance-teaching organization for adult education (Holmberg, 1986).

The original target groups of distance education efforts were adults with occupational, social and family commitments. This remains the primary target group today. Distance education provided the opportunity to widen intellectual horizons, as well as the chance to improve and update professional knowledge. Further, it stressed individuality of learning, and flexibility in both the time and place of study.

Two philosophies of distance education became identifiable. The full liberalism of programs offered by Hermod's, in Sweden, emphasized the free pacing of progress through the program by the student. Other programs, such as those offered by the University of Chicago, offered a more rigid schedule of weekly lessons (Holmberg, 1986).

In Europe, there was steady expansion of distance education, without radical changes in structure, but with gradually more sophisticated methods and media employed. Audio recordings were used in instruction for the blind, and in language teaching for all students. Laboratory kits were used in such subjects as electronics and radio engineering. Virtually all large-scale distance teaching organizations were private correspondence schools (Holmberg, 1986).

In the United States, advances in electronic communications technology helped determine the dominant medium of distance education. In the 1920s, at least 176 radio stations were constructed at educational institutions, although most were gone by the end of the decade. The surviving stations were mostly at land grant colleges, which were committed to independent study (Buckland & Dye, 1991).

In the early 1930s, experimental television teaching programs were produced at the University of Iowa, Purdue University, and Kansas State College. However, it was not until the 1950s that college credit courses were offered via broadcast television: Western Reserve University was the first to offer a continuous series of such courses, beginning in 1951 (Buckland & Dye). Sunrise Semester was a well-known televised series of college courses offered by New York University on CBS from 1957 to 1982 (Buckland & Dye).

Satellite technology, developed in the 1960s, and made cost-effective in the 1980s, enabled the rapid spread of instructional television. Federally funded experiments, such as the Appalachian Education Satellite Project (1974-75) in the United States and Canada demonstrated the feasibility of satellite-delivered instruction. However, these early experiments were loudly criticized for being poorly planned (Albright, 1988). More recent attempts at satellite-delivered distance education have been more successful. The first state educational satellite system, Learn/Alaska, was created in 1980. It offered six hours of instructional television daily to 100 villages, some of them accessible only by air (Johnson, 1988). The privately-operated TI-IN Network, of San Antonio, Texas, has delivered a wide variety of courses via satellite to high schools across the United States since 1985.

The 1962 decision that the University of South Africa would become a distance teaching university brought about a fundamental change in the way distance education was practiced in much of the world. Another landmark was the founding, in 1971, of the Open University of the United Kingdom, a degree-giving distance teaching university offering full degree programs, sophisticated courses, and the innovative use of media (Holmberg, 1986). The Open University brought heightened prestige to distance education, and spurred the establishment of similar institutions in industrial nations, such as West Germany, Japan, and Canada, as well as such lesser-developed nations as Sri Lanka and Pakistan (Holmberg, 1986).

While the distance-teaching universities shared numerous similarities, they were not identical in their mission or practice. Two of the largest and most influential, the Open University of the United Kingdom and the German FernUniversität, differ widely. The British school favors employed, part-time students of above normal study age, and allows them to enroll without formal entrance qualifications. By 1984, some 69,000 of its students had completed work for the Bachelor of Arts degree (Holmberg, 1986).

The German FernUniversität, founded in 1975, offers a more rigorous program than its British counterpart. Despite strict, formal entrance requirements, it had 28,000 students in 1985. However, the dropout rate is very high, and in its first decade, had only 500 students complete the full curricula for a university degree (Holmberg, 1986).

Holmberg (1986) cites numerous reasons for the founding of distance-teaching universities, including:

- the need felt in many countries to increase the offerings of university education generally
- a realization that adults with jobs, family and social commitments contributed a large group of prospective part-time university students
- a wish to serve both individuals and society by offering study opportunities to adults, among them disadvantaged groups
- the need found in many professions for further training at an advanced level
- a wish to support educational innovation

- a belief in the feasibility of an economical use of educational resources by mediated teaching (p. 30)

Theory and Distance Education

Although forms of distance education have been in existence since the 1840s and attempts at theoretical explanations of distance education had been undertaken by leading scholars in the field, the need for a theory base of distance education was still largely unfulfilled in the 1970s. Holmberg (1986) stated that "further theoretical considerations will contribute results of a kind to give to distance educators a firmly based theory, a touchstone against which decisions can be taken with confidence" (p. 132). In 1988, Holmberg continued to recognize the need as he stated,

> One consequence of such understanding and explanation will be that hypotheses can be developed and submitted to falsification attempts. This will lead to insights telling us what in distance education is to be expected under what conditions and circumstances, thus paving the way for corroborated practical methodological application (p. 3).

Moore was concerned about "the progress of distance education being hindered by lack of attention to what he called the 'macro factors'" (Keegan, 1986, p. 69). He indicated that in this area of education there was a need to describe and define the field, to discriminate between the various components of the field, and to identify the critical elements of the various forms of learning and teaching.

Keegan (1988b) reaffirmed the continued need for a theory of distance education when he said, "Lack of accepted theory has weakened distance education: there has been a lack of identity, a sense of belonging to the periphery and the lack of a touchstone against which decisions on methods, on media, on financing, on student support, when they have to be made, can be made with confidence" (p. 63); and more recently, "A firmly based theory of distance education will be one which can provide the touchstone against which decisions--political, financial, educational, social--when they have to be taken, can be taken with confidence". This would replace the ad hoc response to a set of conditions that arises in some 'crisis' situation of problem-solving, which normally characterizes this field of education (Keegan in Holmberg, 1989).

In a general sense, theory is taken to mean a set of hypotheses logically related to one another in explaining and predicting occurrences. Holmberg and Perraton stated that

> the aim of the theoretician is to find explanatory theories; that is to say, the theories which describe certain structural properties of the world, and which permit us to deduce, with the help of initial conditions, the effects to be explained....Theoretical, to bring explanation, on the other hand practical, to provide for application or technology (Holmberg, 1985, p. 5).

Keegan added,

> A theory is something that eventually can be reduced to a phrase, a sentence or a paragraph and which, while subsuming all the practical research, gives the foundation on which the structures of need, purpose and administration can be erected (in Holmberg, 1989, p. 145).

Holmberg recognized that it is perfectly possible to investigate a subject area without any formulated theory with a view to finding the answers to one or more questions. It is now much more common to insist that a theory is needed to guide a study and to help in making deductions. Holmberg (1986) indicated, "a basis for a theory of distance education will be constructed as a descriptive foundation ordering facts and ideas about distance education in a systematic way. A theory explaining and predicting occurrences in distance education is imaginable as far as teaching and learning are concerned" (p. 104).

Holmberg suggested that distance education has been characterized by a trial and error approach with little consideration being given to a theoretical basis for decision-making. He suggested that "the theoretical underpinnings of distance education are fragile. Most efforts in this field have been practical or mechanical and have concentrated on the logistics of the enterprise" (Keegan, 1988b, p. 63).

To some, distance education represents a deviation from conventional education. Holmberg claimed it was a distinct form of education. Keegan (1986, p. 270) concluded that distance education "...is a distinct field of education, parallel to and a complement of conventional education." Shale (1988) countered that "all of what constitutes the process of education when teacher and student are able to meet face-to-face also constitutes the process of education when the teacher and student are physically separated" (p. 26).

Cropley and Kahl (1983) compared and contrasted distance education and face-to-face education in terms of psychological dimensions and claimed neither set of principles emerged in a pure form. Peters strongly stated:

> Anyone professionally involved in education is compelled to presume the existence of two forms of instruction which are strictly separable: traditional face-to-face teaching based on interpersonal communication and industrialized teaching, which is based on objectivized, rationalized technologically-produced interaction (in Keegan, 1986, p. 80).

In his landmark work, *The Foundations of Distance Education*, Keegan classified theories of distance education into three groups:

- theories of independence and autonomy
- theory of industrialization of teaching
- theories of interaction and communication

A fourth category seeks an explanation of distance education in a synthesis of existing theories of communication and diffusion, as well as philosophies of education.

Theories of Independence and Autonomy

Independent Study--Charles Wedemeyer

For Wedemeyer, the essence of distance education was the independence of the student. This was reflected in his preference for the term "independent study" for distance education at the college or university level. Wedemeyer was critical of contemporary patterns of higher education, believed that outdated concepts of learning and teaching were being employed, and that they failed to utilize modern technologies in ways that could alter the institution. (Keegan, 1986)

Wedemeyer set forth a system, its ten characteristics emphasizing learner independence, and adoption of technology as a way to implement that independence:

- The system should be capable of operation any place where there are students--or even only one student--whether or not there are teachers at the same place at the same time.
- The system should place greater responsibility for learning on the student.
- The system should free faculty members from custodial-type duties so that more time can be given to truly educational tasks.
- The system should offer students and adults wider choices (more opportunities) in courses, formats, methodologies.
- The system should use, as appropriate, all the teaching media and methods that have been proved effective.
- The system should mix and combine media and methods so that each subject or unit within a subject is taught in the best way known.
- The system should cause the redesign and development of courses to fit into an "articulated media program."
- The system should preserve and enhance opportunities for adaptation to individual differences.
- The system should evaluate student achievement simply, not by raising barriers concerned with the place, rate, method, or sequence of student study.
- The system should permit students to start, stop and learn at their own pace (In Keegan, 1986, p. 63).

Wedemeyer proposed the separation of teaching from learning as a way of breaking education's "space-time barriers." He suggested six characteristics of independent study systems:

- The student and teacher are separated.
- The normal processes of teaching and learning are carried out in writing or through some other medium.
- Teaching is individualized.
- Learning takes place through the student's activity.

- Learning is made convenient for the student in his own environment.
- The learner takes responsibility for the pace of his or her own progress, with freedom to start and stop at any time (in Keegan, 1986, p. 64).

Wedemeyer noted four elements of every teaching-learning situation: a teacher, a learner or learners, a communications system or mode, and something to be taught or learned. He proposed a reorganization of these elements that would accommodate physical space and to allow greater learner freedom. Key to the success of distance education, Wedemeyer believed, was the development of the relationship between student and tutor.

Independent Study--Michael Moore

Formulated in the early 1970s, Moore's theory of distance education, which he calls "independent study", is a classification method for distance education programs. Shaped in part by Moore's adult education and university extension experience, it examines two variables in educational programs: the amount of learner autonomy and the distance between teacher and learner.

For Moore, distance is composed of two elements, each of which can be measured. First is the provision for two-way communication (dialog). Some systems or programs offer greater amounts of two-way communication than others. Second is the extent to which a program is responsive to the needs of the individual learner (structure). Some programs are very structured, while others are very responsive to the needs and goals of the individual student.

In the second part of his theory, Moore addresses learner autonomy. He notes that in traditional school settings learners are very dependent on teachers for guidance, and that in most programs, conventional and distance, the teacher is active, while the student is passive.

In distance education, there is a gap between teacher and student, so the student must "accept a high degree of responsibility for the conduct of the learning program" (Keegan, 1986, p. 74). The autonomous learner needs little help from the teacher, who may be more of a respondent than a director. Some adult learners, however, require "help in formulating their learning objectives and in identifying sources of information and in measuring objectives" (Keegan, 1986, p. 74).

Moore classifies distance education programs as "autonomous" (learner-determined) or "non-autonomous" (teacher-determined), and gauges the degree of autonomy accorded the learner by answering the following three questions:

- Autonomy in setting of objectives? Is the selection of learning objectives in the program the responsibility of the learner or of the teacher?
- Autonomy in methods of study? Is the selection and use of resource persons, of bodies and other media, the decision of the teacher or the learner?
- Autonomy in evaluation? Are the decisions about the method of evaluation and criteria to be used made by the learner or the teacher? (Keegan, 1986, p. 75).

Theory of Industrialization of Teaching--Otto Peters

In a major treatise on education, Otto Peters of Germany developed a view of distance education as an industrialized form of teaching and learning. He examined a research base formed in his work that included an extensive analysis of the distance teaching organizations of the 1960s. This led him to propose that distance education could be analyzed by comparison with the industrial production of goods. He stated that "...from many points of view conventional, oral, group-based education is a pre-industrial form of education." (in Keegan, 1986, p. 81). His statement implied that distance teaching could not have existed before the industrial era. Based on economic and industrial theory, Peters (1988), proposed the following new categories (terminology) for the analysis of distance education.

A. rationalization: the use of methodical measures to reduce the required amount of input of power, time and money. In distance education, "ways of thinking, attitudes and procedures can be found which only established themselves in the wake of an increased rationalization in the industrialization of production processes." (p. 98)

B. division of labor: division of a task into simpler components or subtasks. In distance education, the conveying of information, counseling, assessment and recording of performance, are performed by separate individuals. To Peters, "the division of labor is the main prerequisite for the advantages of [distance education] to become effective." (p. 100)

C. mechanization: the use of machines in a work process. Distance education, Peters notes, would be impossible without machines. "Duplicating machines and transport systems are prerequisites, and later forms of distance teaching have the additional facilities of modern means of communication and electronic data processing installations." (p. 101)

D. assembly line: commonly, a method of work in which workers remain stationary, while objects they are working on move past them. In traditional distance education programs, materials for both teacher and student are not the product of an individual. Rather, instructional materials are designed, printed, stored, distributed and graded by specialists.

E. mass production: the production of goods in large quantities. Peters noted that, because demand outstrips supply at colleges and universities, there has been a trend toward large-scale operations not entirely consistent with traditional forms of academic teaching. Mass production of distance education courses, however, can enhance quality, Peters believed that "the large number of courses produced forces distance teaching organizations to analyze the requirements of potential distance learners far more carefully than in conventional teaching and to improve the quality of the courses." (p. 103)

F. preparatory work: determining "how workers, machines and materials can usefully relate to each other during each phase of the production process." Peters believed that the success of distance education "depends decisively on a 'preparatory phase'. It concerns the development of the distance study course involving experts in the various specialist fields with qualifications also often higher than those of other teachers involved in distance study." (p. 104)

G. planning: the "system of decisions which determines an operation prior to it being carried out." Peters notes that planning is important in the development phase of distance education, "as the contents of correspondence units, from the first to the last, must be determined in detail, adjusted in relation to each other and represented in a predetermined number of correspondence units." The importance of planning is even greater when residential study is a component of a distance education program: "these supplementary teaching events are not intended to repeat academic contents already offered, nor have an 'enrichment' function, but should be structurally integrated in the distance study course." (p. 104)

H. organization: "creating general or permanent arrangements for purpose-oriented activity." Peters notes the relationship between rational organization and effectiveness of the teaching method. "Organization...makes it possible for students to receive exactly predetermined documents at appointed times, for an appropriate university teacher to be immediately available for each assignment sent in, [and] for consultations to take place at fixed locations at fixed times...." Organization, Peters points out, is optimized in large distance education programs. (p. 105)

I. scientific control methods: by which "work processes are analyzed systematically, particularly by time studies, and in accordance with the results obtained from measurements and empirical data the work processes are tested and controlled in their elementary details in a planned way, in order to increase productivity, all the time making the best possible use of working time and the staff available." In distance education, some institutions hire experts to apply techniques of scientific analysis to the evaluation of courses. (p. 106)

J. formalization: the predetermination of the phases of the manufacturing process. In distance education, "all the points in the cycle, from student to distance teaching establishment to the academics allocated, must be determined exactly." (p. 106)

K. standardization: the limitations of manufacture to a restricted "number of types of one product, in order to make these more suitable for their purpose, cheaper to produce and easier to replace." In distance education, "not only is the format of the correspondence units standardized, [so is] the stationery for written communication between student and lecturer, and the organizational support, as well as each single phase of the teaching process, but also the academic contents." (p. 107)

L. change of function: the change of the role or job of the worker in the production process. In distance education, change of function is evident in the role of the lecturer. "The original role of provider of knowledge in the form of the lecturer is split into that of study unit author and that of marker; the role of counselor is allocated to a particular person or position. Frequently, the original role of lecturer is reduced to that of a consultant whose involvement in distance teaching manifests itself in periodically recurrent contributions." (p. 108)

M. objectification: the loss, in the production process, of the "subjective element which used to determine craft[s]men's work to a considerable degree." (p. 108) In distance education, "most teaching functions are objectified as they are determined by the distance study course as well as technical means. Only in written communication with the distance learner or possibly in a consultation or the brief additional face-to-face events on campus has the teacher some individual scope left for subjectively determined variants in ...teaching method." (p. 109)

N. concentration and centralization: because of the large amounts of capital required for mass production and the division of labor, there has been a trend to "large industrial concerns with a concentration of capital, a frequently centralized administration, and a market that is not seldom monopolized." (p. 109) Peters noted the trend toward distance education institutions serving very large numbers of students. The Open University of the United Kingdom, for instance, had more than 70,000 students in 1988. It is more economical to establish a small number of such institutions serving a nation population, rather than a larger number of institutions serving regional populations.

Peters (p. 100) concluded that for distance teaching to become effective, " the principle of the division of labor is thus a constituent element of distance teaching." The teaching process in his theory of industrialization is gradually restructured through increasing mechanization and automation. He stated that:

- The development of distance study courses is just as important as the preparatory work taking place prior to the production process.
- The effectiveness of the teaching process is particularly dependent on planning and organization.
- Courses must be formalized and expectations from students standardized.
- The teaching process is largely objectified.
- The function of academics teaching at a distance has changed considerably vis-a-vis university teachers in conventional teaching.
- Distance study can only be economical with a concentration of the available resources and a centralized administration (p. 110).

According to Peters, "within the complex overall distance teaching activity one area has been exposed to investigation that had been regularly omitted from traditional didactic analysis" (p. 111). New concepts were used to describe new facts that merit attention. He did not deny there were disadvantages to a theory of the industrialization of teaching but in any exploration of teaching, a recognition of the industrial structures characteristic of distance teaching need to be taken into account in decision-making.

Theory of Interaction and Communication

Guided Didactic Conversation -- Börje Holmberg

Holmberg's theory of distance education, what he calls "guided didactic conversation," falls into the general category of communication theory. Holmberg notes that his theory "seems to have explanatory value in relating teaching effectiveness to the impact of feelings of belonging and cooperation as well as to the actual exchange of questions, answers and arguments in mediated communication" (1986, p. 123).

Holmberg offers seven "background assumptions" for his theory (p. 123):

- that the core of teaching is interaction between the teaching and learning parties; it is assumed that simulated interaction through subject-matter presentation in pre-produced courses can take over part of the interaction by causing students to consider different views, approaches and solutions and generally interact with a course
- that emotional involvement in the study and feelings of personal relation between the teaching and learning parties are likely to contribute to learning pleasure
- that learning pleasure supports student motivation
- that participation in decision-making concerning the study is favorable to student motivation
- that strong student motivation facilitates learning
- that a friendly, personal tone and easy access to the subject matter contribute to learning pleasure, support student motivation and thus facilitate learning from the presentations of pre-produced courses, i.e., from teaching in the form of one-way traffic simulating interaction, as well as from didactic communication in the form of two-way traffic between the teaching and learning parties
- that the effectiveness of teaching is demonstrated by students' learning of what has been taught.

These assumptions, Holmberg believes, are the basis of the "essential teaching principles of distance education." From these assumptions he formed his normative teaching theory: "Distance teaching will support student motivation, promote learning pleasure and make the study relevant to the individual learner and his/her needs, creating feelings of rapport between the learner and the distance-education institution (its tutors, counselors, etc.), facilitating access to course content, engaging the learner in activities, discussions and decisions and generally catering for helpful real and simulated communication to and from the learner" (p. 123).

Holmberg himself notes that this is "admittedly a leaky theory" (1986, p. 125). However, he adds, "...it is not devoid of explanatory power: it does, in fact, indicate essential characteristics of effective distance education." Further, it is apparently logically consistent and it does "establish functional relationships between teaching and expected outcome of learning " (p. 125).

A Synthesis of Existing Theories -- Hilary Perraton

Perraton's theory of distance education is composed of elements from existing theories of communication and diffusion, as well as philosophies of education. It is expressed in the form of 14 statements, or hypotheses. The first five of these statements concern the way distance teaching can be used to maximize education:

- You can use any medium to teach anything.
- Distance teaching can break the integuments of fixed staffing ratios which limited the expansion of education when teacher and student had to be in the same place at the same time.
- There are circumstances under which distance teaching can be cheaper than orthodox education, whether measured in terms of audience reached or of learning.
- The economies achievable by distance education are functions of the level of education, size of audience, choice of media and sophistication of production.
- Distance teaching can reach audiences who would not be reached by ordinary means.

The following four statements address the need to increase dialogue:

- It is possible to organize distance teaching in such a way that there is dialogue.
- Where a tutor meets distance students face-to-face, the tutor's role is changed from being a communicator of information to that of a facilitator of learning.
- Group discussion is an effective method of learning when distance teaching is used to bring relevant information to the group.
- In most communities there are resources which can be used to support distance

learning to its educational and economic advantage.

The final five statements deal with method:

- A multi-media program is likely to be more effective than one which relies on a single medium.
- A systems approach is helpful in planning distance education.
- Feedback is a necessary part of a distance-learning system.
- To be effective, distance-teaching materials should ensure that students undertake frequent and regular activities over and above reading, watching or listening.
- In choosing between media, the key decision on which the rest depend concerns the use of face-to-face learning. (Perraton, 1988, p. 37)

A Theoretical Framework for Distance Education--Desmond Keegan

Keegan (1986) suggested that the theoretician had to answer three questions before developing a theory of distance education:

First, *is distance education an educational activity*? Keegan's answer was that, while distance education institutions possess some of the characteristics of businesses, rather than of traditional schools, their educational activities are dominant. Distance education is a more industrialized form of education. The theoretical bases for distance education, Keegan pointed out, were within general education theory.

Second, *is distance education a form of conventional education*? Keegan believed that, because distance education is not based on interpersonal communication and is characterized by a privatization of institutionalized learning (as is conventional education), it is a distinct form of education. Therefore, while the theoretical basis for distance education could be found within general education theory, it could not be found "within the theoretical structures of oral, group-based education" (p. 116).

Third, *is distance education possible? Is it a contradiction in terms*? Keegan points out that if education requires intersubjectivity--"a shared experience in which teacher and learner are united by a common zeal"--then distance education is a contradiction in terms. Distance instruction is possible, but distance education is not (p. 118).

Central to Keegan's concept of distance education is the separation of the teaching acts in time and place from the learning acts. Successful distance education, he believes, requires the reintegration of the two acts: "The intersubjectivity of teacher and learner, in which learning from teaching occurs has to be artificially recreated. Over space and time, a distance system seeks to reconstruct the moment in which the teaching-learning interaction occurs. The linking of learning materials to learning is central to this process" (p. 120).

Reintegration of the act of teaching at a distance is attempted in two ways. First, "Learning materials, both print and non-print, are designed to achieve as many of the characteristics of interpersonal communication as possible" (p. 122). Second, when courses are presented, reintegration of the teaching act is attempted by a variety of techniques, including: "communication by correspondence, telephone tutorial, on-line computer communication, comments on assignments by tutors or computers, teleconferences, etc." (p.122).

The process of reintegrating the act of teaching in distance education, Keegan suggests, results in at least five changes to the normal structure of oral, group-based education (p. 125):

- the industrialization of teaching
- the privatization of institutional learning
- change of administrative structure
- different plant and buildings
- change of costing structures

Keegan offers three hypotheses drawn from his theoretical framework (p. 126):

- distance students have a tendency to drop out in those institutions in which structures for the reintegration of the teaching acts are not satisfactorily achieved
- distance students have difficulty in achieving quality of learning in those institutions in which structures for the reintegration of the teaching acts are not satisfactorily achieved

- the status of learning at a distance may be questioned in those institutions in which the reintegration of the teaching acts are not satisfactorily achieved

Summary

Distance education has numerous meanings because the term has been applied to a wide variety of programs serving numerous audiences via a wide variety of media. For instance, in England, distance education is exemplified by the Open University of the United Kingdom, serving a non-traditional, adult population via electronic telecommunications, while in Zimbabwe, the University of Zimbabwe supplements teacher education with print-based correspondence courses. So, a definition of distance education may be valid in one place and time, but not in another. Arguably the best-known definition of distance education has been offered by Keegan, who has combined the essential elements from many definitions of distance education.

The history of distance education is relatively brief, only about one hundred years. Two characteristics have marked its development. First, there has been the adoption of increasingly sophisticated communications technologies as such technologies have become available. Second, distance education has developed in each locale in accordance with local resources and the philosophy of the organizations providing instruction.

The development and study of distance education have been hampered by the lack of a generally accepted theory of distance education. The problem has not been a lack of proposed theories. Numerous theories have been proposed, falling into two categories: theories that attempt to explain distance education by drawing on existing theories of education and communication (such as Perraton's), and theories created "from scratch" (such as Peters'). These theories have been shaped by the experiences of the researchers, who have approached distance education from their own angle; a particular paradigm of distance education. Wedemeyer's concern with the independence of the student reflected his experiences with adult students served by university extension programs. Peters' preoccupation with the industrialization of distance education reflected distance education as it has been practiced in his native Germany. It is for this reason that it is so difficult to name a single "best" theory of distance education. Just as definitions vary by time and locale, so does the explanatory power of a theory. A theory that has adequate explanatory power at one time and in one place may be inadequate at another time and in another place. Distance education as practiced at the FernUniversität in Germany is as unlike distance education as practiced in Iowa via the Iowa Communications network as it is unlike the University of Zimbabwe's correspondence study program. It may be asking too much for one theory to adequately address distance education in all its manifestations.

Perraton's synthesis of existing theories of distance education is, arguably, the most powerful theory so far advanced for distance education as it is practiced today in most parts of the world. It is less adequate as a theory of distance education as practiced in the United States. However, it is worth asking if distance education, as practiced in the United States, requires its own distinctive theory. There is evidence that the answer to this question is "no".

At the root of distance education theory is the belief that distance education is fundamentally different from traditional, face-to-face instruction. Keegan made what was, in 1986, a convincing case for this view. However, especially in the United States, technological advances and new philosophies of distance education have resulted in a new paradigm of distance education, its goal to offer to the distance student an experience as much like that of traditional, face-to-face instruction as possible. A refinement of this approach, what might be called the "Iowa Model," featuring intact classrooms and live, two-way interaction, comes closest to realizing the goals of the American concept of distance education. Further advances are inevitable, resulting in greater "transparency" of distance education technology and offering greater similarity with traditional classroom instruction. It is known that good distance education pedagogy is good pedagogy in any classroom. In the future, if indeed not now, it may be that good education theory and good distance education theory will be one and the same.

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Distance Education--Review of the Research

In his 1987 article, "The Development of Distance Education Research," Börje Holmberg, a leading distance education theorist and researcher, suggested that research into distance education be divided into eight categories:

- philosophy and theory of distance education
- distance students, their milieu, conditions and study motivations
- subject-matter presentation
- communication and interaction between students and their supporting organization (tutors, counselors, administrators, other students)
- administration and organization
- economics
- systems (comparative distance education, typologies, evaluation, etc.)
- history of distance education (Holmberg, 1987, p. 20)

Each of these areas of research is, indeed, represented in the literature. However, each area is not equally represented. A number of factors related to the nature of distance education make this so. Because the field (and, by extension, its practitioners) is so practical, research in distance education has been dominated by attempts to answer questions of immediate, practical significance. Further, a tendency of the field to be supportive of a liberal view of education and free access to the benefits of education has led its researchers to emphasize questions dealing with the student. Therefore, two of Holmberg's categories of distance education research, *distance students, their milieu, conditions and study motivations*, as well as *systems* (media comparison studies), dominate the literature. On the other hand, because of the relative youth of the field, Holmberg's final category, *history of distance education*, is the subject of few studies.

The practical nature of distance education not only influences the *subject* of research, it also influences the *type* of research conducted. A large percentage of the literature about distance education is of the first-person, "how-I-did-it" variety, such as accounts of how distance education was adopted in one school or community. Such accounts can be very interesting, and perhaps informative, but they are anecdotal in nature and lack the rigor required to be properly termed "research."

Further, much of the research in distance education is of the case-study variety, examining a single program or school. As such, this research lacks generalizability to the field of distance education, and when a single course is the object of study, the data may not even be generalizable to the entire distance education program of a given institution. Worse, there is some question as to the validity of some studies. Much of the research is small-scale and exploratory in nature. Studies reporting data drawn from fewer than 20 questionnaires have been published, as well as from experiments comparing student achievement and attitudes based on 13-minute treatments (lessons).

One reason for the ubiquity of such articles is the very nature of distance education as it is being practiced today. Particularly in the United States, distance education is undergoing a period of rapid change, of redefinition; what Rogers (1983) calls "re-invention." While distance education is some one hundred years old, the field is being reborn, the result of newer technologies that have substantially changed the nature of distance education. The explosion of interest in the field, manifested by greater numbers of outlets for scholarly research (professional research journals, conferences, and so on), as well as articles in the more mainstream education journals and the popular press, has been fueled by the availability and application of these technologies.

This chapter will discuss three of Holmberg's categories of research: *distance students, their milieu, conditions and study motivations*; will be addressed first, followed by *systems of distance education*. Elements of Holmberg's third category, *communication and interaction between students and their supporting organization*, will be blended into the above two categories, where appropriate. It should be noted that other categories are dealt with in other chapters of this monograph. The *philosophy and theory of distance education*, as well as its *history*, are discussed in chapter one. *Administration and organization*, and, *economics*, are outlined with other operational issues in the next section of this monograph, "Distance Education--Operational Issues."

Distance Students--Their Milieu, Conditions, and Study Motivation

Within this broad category of research dealing with the role of students, many studies have attempted to discover reasons for student success or failure in distance education courses. Special emphasis has been placed on explaining the high incidence of dropout that has historically plagued this form of education. Among the variables examined have been: locus of control, academic and social integration variables, motivation, and learning styles.

Before one can suggest a cure for a problem, it is necessary to first determine if there is, indeed, a problem. Then, exploratory research can be used to learn the dimensions and gain an understanding of the problem.

In a 1980 study, Coldeway (1991) asked adult distance education students about their course-related behavior, their activity and interaction with staff, their study habits, and motivation. He found that:

- Students managed their time in a variety of ways that had more to do with their own lifestyles and schedules than the way the courses were structured.
- Most students progressed through courses more slowly than the institution suggested.
- Most students did not study consistently, and their study was frequently disrupted by events unrelated to the course.
- Motivation was not a stable characteristic: it was higher when the student approached an assessment point or "had an important interaction with a member of the instructional staff of the institution (usually a telephone tutor)" (p. 8).
- Students conferred with tutors far less frequently than school policy prescribed.
- Attrition rates were somewhat inflated by the number of students who enrolled in courses, did very little work but did not officially withdraw. These students (referred to as non-starts) later withdrew or were withdrawn, but "it appeared that the course, per se, had little impact on their resulting non-start withdrawal" (p. 8).

Coldeway concluded that "learner motivation was a somewhat fragile thing," (p. 8) and that "hypothesized strong motivational factors for students (e.g. need to learn, need for credit and credentials, something to fill time, etc.) are overshadowed by competing factors in the personal lives of students" (p. 9).

A replication of the study, reported by Coldeway in 1991, indicated very little change in student behavior. First, study time per week was up only slightly, from 5.2 hours to 5.9 hours. Second, the average self-reported motivation level was also up slightly, from 3.7 to 4.23 (on a 7-point scale). Finally, student contact with course coordinators and tutors via telephone was approximately the same as in the earlier study (p. 9).

Coggins, (1988) in a study of students associated with the University of Wisconsin System External Degree Program, examined the relationship between "personal variables" (learning style and demographic data) and program completion rate. She found that completers and noncompleters did not differ significantly on variables related to gender, occupation, marital status, presence or absence of children, distance from campus, or age of entry into the baccalaureate program. However, there was a significant difference between the two groups on a number of variables. Completers had entered the program with higher levels of education and they had greater expectations of earning higher grades, as well as a degree.. Interestingly, the two groups of students differed in preferred course content: noncompleters tended to prefer inanimate objects-related content over people content .

Laube (1992) compared characteristics of completer/persisters and dropout/nonstarters in a Canadian secondary distance education program. He found that:

- The completer/persister group tended to have post-secondary education goals, while the dropout/nonstart group tended to have secondary education goals.
- Completer/persisters tended to study more than dropout/nonstarters.
- The two groups did not differ significantly in the amount of assistance they received at home in completing their assignments.

- The two groups did not differ significantly in the amount of contact they initiated with the school.

- Completer/persisters were overwhelmingly positive in their attitude toward their graders and tutors. Dropout/nonstarters also tended to hold positive views, but a substantial number were undecided.

- The two groups did not differ significantly in the degree to which they missed socializing with their peers.

Dille and Mezack (1991) identified predictors of high-risk among college distance education students. They found that:

- Successful students were more internally oriented than non-successful students, and, as such, "would be expected to persevere more than their more external classmates because 'internals' perceive events as contingent upon their own behavior" (p. 29).

- Learning style (as measured by David A. Kolb's Learning Style Inventory), "was not a significant variable in predicting success or non-success in a telecourse" (p. 31).

- Grade point average of successful students was higher than that of non-successful students.

- Successful students were older than non-successful students.

- Marital status was related to academic success. Married students were most successful, while divorced students were least successful.

- Ethnic background, sex, and number of children or children living at home were not statistically significant in their effect on student performance. Neither were "number of college credit hours for current term, reason for taking the telecourse rather than an on-campus class, previous experience with telecourses, student perception of own learning style, reason for taking the telecourse, and importance of completing the telecourse" (p. 33).

When college students withdraw from distance education courses, one frequently offered reason is a lack of time. Garland (1993) applied the qualitative methodology of ethnography in a study designed to gain a better understanding of the motivations for student withdrawal. Ethnography, as Garland defines it, "penetrates facades to represent and elucidate cultural knowledge, what can and cannot be said, as influenced by subjectivity and power relationships" (p. 9). It does so by "making inferences from what people say and what is assumed to what they know, to their psychological reality" (p. 6).

What Garland's study revealed was that students' claim of lack of time was "a socially acceptable explanation," and "a simplified explanation of the difficulties they were experiencing" (p. 8). While time constraints were indeed a factor in dropout, the true reasons for the students' withdrawal, Garland found, were more complex, including: lack of prerequisite knowledge of the course content, lack of support from peers and family, stress, poor grades, procrastination, need for face-to-face interaction, pride, poor tutor feedback, weak goal commitment, and fear of failure (p. 8). Many of the problems cited by dropouts were shared by persisters as well, leading Garland to note that "there is a complicated mix of situational, institutional, dispositional and epistemological problems which pose barriers to persistence and which combine and interact to result, for some students, in a dropout decision that is essentially idiosyncratic in nature" (p. 10). These categories are defined in the following way:

> Situational problems include those associated with the student's milieu, such as poor family support, multiple roles and a lack of free time. Institutional barriers comprise cost, bureaucracy, and problems with tutorial support and instructional design. Dispositional problems reflect the student's psychological and sociological makeup. They include unclear goals, procrastination, learning style problems, pride and lack of self-confidence (p. 10).

In addition, there may be epistemological problems, such as "'course 'difficulty', problems with subject matter, academic incompatibility, or course structure/need for specialized competence" (p. 10).

One approach to explaining adult student dropout from distance education has been the development, by David Kember, of a "Longitudinal-Process Model" (1989). His model is based on models used in other fields of education not directly applicable to the field of distance education. Models differ from theories.

To explain a construct such as dropout (attrition), Kember noted, a theory

> ...would contain so many constructs that it would become unwieldy if not unmanageable. Such situations call for the use of theoretical models, which are simplified versions of reality that strip away the minute details to concentrate on factors that are assumed or deduced to be important (p. 279).

There are five components of Kember's model:

1. Characteristics

Individual, family, and work backgrounds have weak direct correlations with dropout. However, they influence other components of the model. *Educational background* (formal school qualifications or examination results). Has "an influence on later components of the model rather than predictors of success or barriers for entry to the course" (p. 291). Students with limited schooling may be expected to have difficulty with academic integration, and their study approach may not be suited for college-level work.

2. Goal commitment

Extrinsic motivation is the level of commitment to completion of a course or program.

Intrinsic motivation is "the level of interest in the subject matter itself or interest in learning for its own sake" (p. 292). Research has suggested that, of the two, "intrinsic motivation produces a stronger goal commitment," (p. 292) and is therefore "more likely to contribute to successful completion of a course" (p. 293).

3. Academic aspects

For Kember, "the academic environment is taken to include all facets of the offering of the distance education course of study by the institution" (p. 293). This includes course materials, tutorial assistance, and any other form of interaction between student and institution. With regard to course materials, the student requires "normative congruence." That is, course content and curriculum should be compatible with "students' perceived career needs and interests" (p. 293). Interaction and tutorial assistance lead to "collective affiliation" and help to determine if students have positive feelings toward the institution.

4. Social and work aspects

Students must be able to "integrate the demands of part-time off-campus study with family, work, and social commitments" (p. 294).

5. Cost/benefit analysis

Kember noted that the distance education student "has to decide whether the opportunity costs of time spent studying are worthwhile in view of the perceived benefits of the eventual qualification or other benefits the student might derive from studying" (p. 295). Further, because variables in the model change with time, the student has to continually reassess the costs and benefits of continued study.

Naturally, many distance education college students do not drop out. However, they may face a variety of challenges that may impede their progress in courses. While many of these challenges are not unique to distance education programs or the students enrolled in them, the nature of distance education may be a substantially aggravating factor.

Academic procrastination is not unique to distance education; perhaps 95 percent of college students engage in it (Wilkinson and Sherman, 1990). However, because the distance education student exercises considerable control over his or her own learning, procrastination is of special concern to the distance educator. As Wilkinson and Sherman (1990) noted: "If ever there was an opportunity to procrastinate on academic tasks, distance education offers that opportunity" (p. 47). However, in spite of the widespread nature of procrastination in distance education, little research has been conducted on the subject.

The goal of Wilkinson and Sherman's study was to determine the extent of the problem of academic procrastination by interviewing distance educators. Among the findings of the study were:

- More than one-third (37.5 percent) of distance educators thought academic procrastination by students was frequently or always a problem.
- Sixty-one percent "indicated that 10 percent or less of their distance learners did not complete any assignments. Slightly more than half (51.5 percent) of distance educators "indicated that 10 percent or less withdrew or were

dropped for not completing assignments" (p. 50).

- More than two-thirds said they thought academic procrastination was frequently caused by "cognitive blocks," (inadequate information, unclear priorities, and failure to appreciate the need for timely action, and so on) and environmental conditions (clutter, disorganization, noise, unmanageable workloads, distractions from friends and relatives, and so on).

Wilkinson and Sherman found that distance educators' views on academic procrastination were "based more on impressions and hearsay than systematic observation and analysis" (p. 52). Therefore, "they may also have a distorted idea of the prevalence and importance of academic procrastination" (p. 52).

Although most distance educators studied did not believe that academic procrastination was a major problem, they applied a variety of strategies to reduce it. Wilkinson and Sherman noted that the strategies employed seemed to have "little relationship to their perceptions of student non-completion and academic procrastination or data they had collected...." (p. 52). The researchers surmise that distance educators may "implement these strategies based on an intuitive belief that students will procrastinate unless something is done by programs or faculty" (p. 52).

In a related study, Stone (1992) examined the role of student-tutor contact in timely completion of a college distance education course. Stone found that regular telephone contact between student and tutor did not result in significant improvement in course completion rates. However, he did find that students who were identified as having external locus of control completed their coursework significantly faster when they had regular tutor contact.

Bernt and Bugbee (1993) examined study practices as an explanation of academic success of adults in distance education. The authors cited previous research that indicated that adult learners tend to prefer self-directed modes of learning, have lower expectations of academic success, and are more problem-oriented than curriculum-oriented. The differences are even greater for adult students in distance education programs. They tend to be less schooled, or less-recently schooled, and they may require more "pedagogical contact and more evaluative feedback", but receive less. They have more material to read than students in traditional courses, but they have less time to study it. Finally, because of such stresses and the very independence of independent study, dropout from college distance education courses tends to be high.

Bernt and Bugbee examined two types of study strategy dimensions with distance education students. First, primary strategies, "which are used to identify, understand, remember, and apply important subject matter" (p. 97). Second, secondary or support strategies, "which involve the formation and maintenance of attitudes related to learning and academic performance" (p. 98). The researchers concluded from their study that there was evidence that both primary and secondary strategies aided academic performance. Passers differed significantly from failers in their testwiseness, concentration, and time management skills, but did not differ so greatly in active learning, diligence, and positive attitude.

The researchers also found that students with different education levels differed in their study strategies--in time management, concentration, and testing strategies. This, they concluded, suggests "that distance learning students who have not completed college are 'at-risk' primarily because they lack metacognitive or executive skills for approaching coursework and examination-taking" (p. 108). Such students, the authors believed, may need more structure and direction than more experienced learners.

The relationship between gender and success in distance education courses was the subject of a study by Ross and Powell (1990). Data from the 1987-88 school year at Athabasca University, in Alberta, Canada, indicated that a greater percentage of women passed distance education courses. Further, "this higher completion trend was visible irrespective of the student's general study area, specific course selection, course level, mode of course delivery, student's program status, or the number of courses students had previously taken" (p. 10).

Among the reasons for the greater success of women in distance education courses, the authors speculated, were:

- More males were working outside the home while studying, which could affect academic performance.

- More female students were unmarried, and a greater proportion were single parents. While marital status has been tied to academic achievement, the women in the study "reported that they had someone other than a spouse/partner to rely on for support.

- Women initiated more telephone calls to their tutors, "thereby making better use of institutional support structures" (p. 11).
- More women regarded gaining a university credential from their courses as critical.
- More women regarded failing their first course at the university as serious.
- Many of the female students were working while taking courses and came from fields (such as health care) in which "career advances can be readily achieved through academic upgrading in a distance education environment" (p.11).

Student attitudes toward distance education courses as well as the relationship between attitudes and performance, have also been the subject of a number of studies. In general, these studies indicated that, while students learn equally well from lessons delivered with any medium, face-to-face or at a distance, they preferred the traditional classroom.

In their 1987 study of student perceptions of the effectiveness of graduate college courses taught via the TI-IN satellite system, Barker and Platten (1988) learned the following:

- Students enrolled in the course mainly to earn college credit toward a graduate degree.
- Students enrolled in the course lived an average of about 20 miles from the site where they received the downlink signal.
- A slim majority of students (53.8 percent) felt that the course maintained their interest as well as a traditionally-taught course. Slightly more students (56 percent) said they preferred regular classroom instruction, while more than two-thirds of the students said they would be interested in enrolling in other satellite-delivered courses.
- About half the students (46.2 percent) felt that the course was "somewhat harder" than traditional instruction, while the remaining students were evenly divided between those thinking difficulty was "the same" or "somewhat easier".
- There was limited interaction between students and instructor, with an average of only 6.5 calls from each site during the entire 13-session (three hours each) course. One factor that may have limited the number of calls was the inability of some sites to receive all the broadcasts due to technical problems related to the system.
- Virtually all of the students (96.8 percent) felt that the lesson objectives had been well presented by the instructor, while nearly a third of the students (30.7 percent) felt that the lessons seemed more organized than traditional classroom instruction. However, virtually the same number of students felt that it was easier to let their "mind wander" in the distance education class than in a traditional class.

The aspect of distance education the students most liked (unanimously) was the convenience of taking a graduate course close to home. The greatest weakness of the system, the students felt, was the limited interaction with the instructor and with students at the other sites.

Barker and Platten concluded that satellite-delivered instruction provided a useful service for geographically isolated students, and that it was preferable to older methods of distance instruction, such as traveling professors, non-interactive television, or correspondence study. However, satellite delivery of instruction, in their view, was not "a substitute for traditional classroom instruction if such instruction is available. This is not to criticize satellite courses. We believe that what still works best is a qualified, well-prepared teacher in the classroom" (p. 49).

St. Pierre and Olsen (1991) examined student attitudes toward correspondence study through The Pennsylvania State University. They found that:

- "Motivation was the single most important of the feedback-related independent variables influencing student satisfaction" (p. 67).
- There was a positive relationship between "student satisfaction and the opportunity to apply experiential learning and knowledge" (p. 68).
- "Prompt return of lessons in the beginning of the course was more significant for student

satisfaction than prompt lesson return later in the course" (p. 68).

- "Didactic conversation with the instructor contributed significantly to the satisfaction of students comfortable with this type of exchange" (p. 68). Communication via the mail did not affect student satisfaction with the course.

- The relevance of course content and the helpfulness of the study guide and commentary were significant in predicting satisfaction with the course.

- Interaction between the student and the instructor, as well as the support staff, was only minimally predictive of student satisfaction.

- Students satisfied with one correspondence course were more likely to take another.

The authors concluded that "all students, regardless of their sex or age, seem to be satisfied with correspondence study" (p. 69). Further, they reached a conclusion regarding this form of distance education somewhat at odds with the conclusion reached by Barker and Platten regarding satellite-delivered distance education. To St. Pierre and Olsen, "It should not be viewed only as an alternative to resident instruction for those students unable to take higher education courses through conventional means" (p. 68).

Wilkes and Burnham (1991) examined the link between motivation and satisfaction of adult learners in an electronic distance education environment (EDE). Their findings were at odds with some commonly-held beliefs of adult educators. The authors noted that "It has been presumed that programs and environments tailored to the needs, motives, and expectations of learners will result in higher participant satisfaction than those involving minimal consultation between learners and instructors" (p. 49). However, their study indicated that student satisfaction "is largely independent of the initial motives that impelled individuals to participate", suggesting that "the sources of variation in satisfaction lie elsewhere. There may be other internal variables which affect satisfaction, but external variables are probably more influential" (p. 49).

Wilkes and Burnham noted that "adult learner characteristics may not have much to do with satisfaction" (p. 49), and echoed (albeit somewhat more pithily) what other researchers have said in media comparison studies:

> Those factors which influence good instruction may be generally universal across different environments and populations. From observations and interviews it was concluded that the EDE system exaggerates an instructor's weaknesses. If instructors are boring in a face-to-face setting, they can reach undescribable depths of insipidity coming across the phone lines. A monotone voice is harder to concentrate on when coming from a distance than it is coming from within the same room. (p. 49)

Distance Education Systems

"The best current evidence is that media are mere vehicles that deliver instruction but do not influence student achievements any more than the truck that delivers our groceries causes changes in nutrition" (Clark, 1983, p. 445).

The "best current evidence" to which Clark referred a decade ago was hundreds of media comparison studies that indicated, unequivocally, that there is no inherent significant difference in the educational effectiveness of media. If researchers had not gotten the message before Clark's statement in 1983, they should have gotten it afterward. Further comparisons of the effectiveness of instructional media were not warranted. The specific medium used does not matter. The focus of future research should be the truly critical factor in determining student achievement: instruction itself (Whittington, 1987).

Unfortunately, much of the research being done in distance education is still of the media comparison type. Perhaps this is to be expected given the rapid development of distance education technology, especially in the area of two-way interactive television systems. With each technological advance there is the temptation to conduct media comparison research on the offhand chance that the use of the new technology might truly result in higher student achievement.

Martin and Rainey (1993) compared the achievement of high school students taught anatomy and physiology via satellite with the achievement of their peers who were taught the same material in a traditional classroom. The researchers found that, while there was no significant difference between the two groups in their attitudes towards the course material, the achievement of the distance education students on the post-test was significantly higher than that of the traditionally-taught students. It should be noted that the two groups of students were taught by different teachers.

Egan, et al. (1992) compared student attitudes toward distance and traditional education as well as between two types of distance education. When conventional instruction was compared with live, interactive television, conventional instruction received significantly higher student ratings for organization of course and clarity of course content, relevance of course objectives to class sessions, integration of text and assignments, and value of visual materials and text screens.

When conventional instruction was compared with "Professor Plus," a series of videotapes of conventional instruction plus an on-site instructor/facilitator, the results were similar. In addition to the variables above, students rated conventional instruction superior in adequacy of presenter delivery and student interest. Distance learners regarded the two types of distance education systems as comparable. The authors suggested that this was because of the presence of an instructor/facilitator with the Professor Plus system.

Beare (1989) compared the effectiveness of three instructional formats: videotape, audiotape, and telelecture. Not surprisingly, given the history of media comparison research, "...individual instructional formats had little effect on student achievement..." (p. 64). Nor is it surprising that "...the lack of individual opportunity to interact on a daily basis with the instructor did not reduce student learning as measured by the course examinations" (p. 64).

What is surprising, perhaps, is that "distant learners found the course just as stimulating, were equally interested in the subject matter, and judged the instructor equally as skilled as did those receiving face-to-face instruction" (p. 65). However, personal circumstances of students can affect their attitudes toward the various instructional methods:

> The less formal questions asked of the video-only groups revealed that students respond favorably to video and audio instruction if it is the [only] way they can take the course or--even more important--keep their jobs. Distance education is not received as favorably by those who have a clear option for face-to-face instruction. (p. 66)

Souder (1993) compared the effectiveness of traditional vs. distance (satellite-delivered) instruction in three master's degree programs. Traditional classroom instruction was used to teach students at the Georgia Institute of Technology and the University of Alabama in Huntsville. Students enrolled in the National Technological University received the same instruction via satellite. Mean exam scores for all three groups were quite high, more than 90 on a 100-point scale. However, the NTU (distance) students scored significantly higher on the exam than the Georgia Tech students. The University of Alabama students' scores fell in the middle. The higher scores of the NTU students, the author suggests, may be explained by "age and experience advantages" peculiar to that group (p. 40).

Souder notes that the impact of distance education transcended achievement, that the nature of the particular medium and the form of student-student interaction characteristic of that form, afforded significant other benefits:
"[The distance learners] gained a broadened network of valuable colleagues, skills in working with others and collaborating across distances, and many social skills beyond those offered by traditional classroom settings" (p. 50).

Cheng, Lehman and Armstrong (1991) compared performance of college students enrolled in traditional and computer conferencing classrooms. They found no significant differences between the treatment groups examined in the study. Further, at the end of the course, there were no significant differences among the groups in attitudes toward the subject matter.

Numerous studies have described or examined the efficacy of individual forms of distance education, while others have examined aspects or components of those forms. Garrison (1990) used a description of audio teleconferencing to argue for an appropriate concentration on the role of the teacher and the importance of two-way communication in the education process. Along the way, he argued for the appropriate, conservative use of interactive communication technologies.

The core of Garrison's argument was that:

> ...education, whether it be at a distance or not, is dependent upon two-way communication. There is an increasing realization in the educational community that simply accessing information is not sufficient. In an educational experience information must be shared, critically analyzed, and applied in order to become knowledge. (p. 13)

A goal of some distance education programs is to make education more student-centered through the prepackaging of instructional materials that students may use when convenient. However, Garrison argued that this approach "ignores the essential nature of an educational learning experience" (p. 14). For Garrison, this "simply risks making learning more private and therefore less likely to transform the views and perspectives of the learner in a positive developmental manner" (p. 14).

Garrison argued that "the quality and integrity of the educational process is dependent upon sustained, two-way communication" (p. 15). Such communication, between student and teacher, and between student and student, is the prime benefit of teleconferencing. When this technology is applied to distance education, "the result is that distance education is no longer necessarily an independent and isolated form of learning but, instead, begins to approach the interactive ideal of an educational experience" (p. 15).

Garrison is a staunch supporter of audio teleconferencing, which he regards as "a distinct generation of distance education capable of providing unique and varied teaching/learning possibilities. Independent and isolated study is no longer the hallmark of distance education" (p. 17).

In a study conducted between 1986 and 1988, students in distance education classes offered by the University of Calgary were surveyed about their attitudes toward audio teleconferencing. Nearly all of the students (96 percent) agreed that they had been given adequate direction and support in the use of the equipment and procedures. Somewhat fewer (87 percent) felt that audio quality was at least acceptable. Additionally, the survey revealed that students were willing to take courses delivered by audio teleconferencing "regardless of technological inconveniences" (p. 20). Students seemed to be of two minds about the need to interact with faculty between sessions. Sixty-two percent of the students agreed that this was essential, however, only 40 percent had actually done so.

Garrison is critical of interactive television as a medium of distance education, charging that it is "really audio teleconferencing enhanced with a live television image of the instructor" (p.16). Bauer and Rezabek (1992) measured the effects of two-way visual contact on verbal interactivity during teleconferenced instruction. They compared verbal interaction under three conditions: first, two-way audio and video; second, two-way audio; and third, traditional instruction. The authors found that students in the audio-and-video group were less likely to interact verbally than students receiving two-way audio instruction only. Further, both groups were less likely to interact verbally than students in the traditional classroom.

Burge and Howard (1990) examined the attitudes of students at the University of Toronto toward audio teleconferencing as a form of distance education. Students generally felt successful in their courses: 87 percent said they "often" or "almost always" felt successful. The researchers asked a number of questions concerning the teleconferencing equipment. Approximately 57 percent of the students said practice with the equipment led them to feel more comfortable with it. However, many students felt uncomfortable with some of the equipment and protocols required for interaction. The lack of visual cues in the classroom was a problem for many students. They suggested a variety of ways of fostering personal contact between and among students and the instructor.

Students made many comments about the class moderator and made numerous suggestions. Students asked that moderators develop a personal rapport with students. They stressed the importance of clear planning and organization by the moderator not only regarding the equipment, but also of course materials and procedures.

Russell (1989) described distance education using videocassettes in the Teacher Oriented Televised Education (TOTE) program at North Carolina State University. In this system, a traditionally-taught class is videotaped for use by distance students later. A second-semester Japanese language class was divided into two parts. One group attended the class "live," while it was being recorded. The other group watched the resulting videotapes. Of the students who viewed the tape only:

- Nearly three quarters (71 percent) "felt they did not learn the material as well as they would have in a traditional classroom setting" (however, their test scores were not significantly different from those of the traditionally-taught group).
- Fifty-seven percent believed that the inability to ask questions was the greatest disadvantage of this method of instruction.
- Eighty-eight percent of the students said they "definitely would take an entire language course via TOTE". The remaining students said they "might" (p. 3).

Among students taught in the classroom during the recording:

- All of the students "felt that they learned as well as if they were in a regular classroom not being recorded" (p. 3).
- Just over two-thirds of the students "would not mind having another language course this way." The remaining students said they would welcome the opportunity (p. 3).

Timmins (1989) examined the effectiveness of supplements to print-based distance education. Data from 367 higher education students in Australia indicated that the most valuable supplement to printed material was residential school (one week in length). Computer based instruction and telephone tutorial were judged to be less useful. However, an examination of the students' grades indicates that attendance at residential school "confers no apparent advantage at all" (p. 12) while taking advantage of telephone tutorials and computer based instruction, "is related to an advantage to the final grades of students of 8 to 9 percentage points" (p.13).

Ross, et al. (1991) described two programs for tutoring at-risk elementary school children at a distance; one using a local electronic bulletin board system, and a second using Applelink, a national network system featuring both electronic mail and teleconferencing. In the first program, student reactions were, on balance, negative. More than half of the students did not understand corrections made by their tutors, received little help with their writing skills, received insufficient time with their tutors, found the assignments difficult, and said they did not learn much from their tutors. Slightly more than half the students felt they had enough on-line time to complete messages, but about one third received a busy signal when they called. Most tutors (89 percent) felt that they needed more intensive training and 67 percent said they would have liked more personal contact with their students.

In the second program, student comments were more positive, with the most positive comments concerning tutors. Seventy percent or more of the students: liked their tutor, wanted to spend more time with their tutor, and felt that their tutor liked them. Sixty-nine percent of the students said they liked their assignments, and 65 percent said they learned from their tutors. Eighty percent of the tutors felt that they did not receive adequate communication from classroom teachers, 50 percent said they were able to communicate their expectations to their students, and 60 percent were undecided on whether they enjoyed tutoring.

Johnson (1988) examined the attitudes of students from small, rural Iowa high schools toward interactive satellite instruction. Survey results indicated that the students had the following attitudes:

- The students held positive attitudes toward the strengths of satellite-delivered instruction, especially with regard to personal qualities of the teacher.
- Although students talked with their instructor only once a week, they were positive in their rating of student-teacher interaction.
- Students were only slightly positive in their attitude toward the benefits of satellite-delivered instruction beyond course content. They did not judge opportunities to establish relationships with other students and the development of independent learning to be among the major benefits of TI-IN.
- Students believed that TI-IN courses were easier than regular classes. This finding is contrary to previous research in the field.
- Although students were generally supportive of satellite-delivery of courses, they preferred traditionally-taught courses.

Jurasek (1993) surveyed the attitudes and perceptions of graduate students toward compressed video distance education technology. She found that students had a generally positive attitude toward both compressed video technology as a method of instruction delivery, as well as opportunities for interaction provided by the system. In both cases, students at the distant classroom had a significantly more positive attitude than students at the origination site. There was no significant difference in the average grades earned by the students at the two sites.

Summary

While it is always perilous to summarize research in a few sentences, it is also the obligation of those who have studied the literature extensively to provide others with their best estimates of what is reported. The distance education literature has several characteristics that make summarizations difficult, including:

- Distance education literature is largely anecdotal. Authors tend to publish reports of the results of a specific distance education project which makes generalization to other projects difficult.

- Distance education literature is dominated by comparison studies in which students learning at a distance are compared to students learning in a traditional classroom. This approach to research is widely criticized and is suspect. Generalizations about comparison study research are difficult.

- There are many approaches to the practice of distance education, and the techniques used (e.g., print-based correspondence versus live, two-way interactive television) are so different, that comparing them and summarizing the results is problematic.

- Much of the research in distance education has involved adult, off-campus college students, as well as highly motivated college-bound high school students. Conclusions reached with such populations may not generalize well to other populations.

- Finally, distance education is an emerging discipline that is practiced most often by non-researchers who either do not publish, or do not provide documents that "fit the mold" of traditional research.

In spite of these limitations, it is possible to draw the following tentative conclusions from the research literature. While these summary statements should be interpreted skeptically, they are supported by the literature.

- Students learning at a distance have the potential to learn just as much and as well as students taught traditionally. The factors that determine learning are the same for distant students as they are for traditional students, including student characteristics such as motivation, intelligence, level of preparation, and instructor variables such as quality of teaching, organization, and structure of the course.

- In spite of the fact that students perform as well in a distance education environment as in a traditional classroom, and appreciate the flexibility and convenience offered by distance education, students prefer the traditional classroom.

- Good distance teaching pedagogy is not fundamentally different from good traditional teaching technique. However, because of the nature of distance education and its technologies (e.g., two-way interactive television), distance educators should consider the following in order to improve their effectiveness:

  A. Extensive pre-planning is necessary: teachers cannot "wing it" in distance education.

  B. Structured note taking, using tools such as interactive study guides, contributes to effectiveness.

  C. The use of visuals, or graphics, can have a major impact on the success of a distance education course. However, to be effective, these visuals need to be tailored to the characteristics of the particular medium, and require considerable thought and preparation "up front."

  D. To be effective distance educators, teachers need proper training, both in the use of equipment, and in those techniques that have proven effective in the distance education environment. Unfortunately, opportunities for such training are rare.

Finally, the research clearly shows that distance education is an effective method for teaching and learning. Therefore, decisions about the adoption of distance education by schools or students should probably be based on considerations such as curriculum enrichment, cost effectiveness, and availability of alternative forms of instruction.

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Distance Education--Operational Issues

Introduction

"The organizational pattern and operating practices of a distance education establishment are, of course, based on the educational philosophy of that institution as well as some economic and political restrictions" (Verduin & Clark 1991, p. 166).

A well run distance education enterprise is the product of people, planning and technology. It does not happen over night nor is it bereft of problems. As the power of technology increases at rates that seem exponential in nature, the intricacies of operating distance programs on a daily basis become equally complicated (Rumble, 1992; Verduin & Clark, 1991). In any endeavor of such sizable scope it is inevitable that despite the most careful planning, issues will arise that require policies to be determined and put into place (Murgatroyd & Woudstra, 1989; Hezel, 1991; Miller, 1991).

Purpose

It is the purpose of this chapter to review operational issues related to the administration and management of distance education. For the purpose of this chapter operational issues are defined as those issues related to the administration and management of the enterprise of distance education. Of primary interest are those policies that provide a structure for successful distance education programs.

It is possible to glean, from currently available literature, a number of common issues inherent in the operation of distance education programs. These issues can be divided into 3 major categories:

* personnel
* facilities
* curriculum

Among the issues included within these categories are: training and evaluation of teachers, students, and staff; implementing and managing the technologies used; support services for teachers and students; equipping, scheduling and maintaining facilities; and making decisions about content, development and evaluation of curriculum.

This chapter will examine each of these categories and the issues within them. It will look at the decision making structure that examines the issues and develops policies designed to facilitate effective solutions.

Issues: Far Reaching Scope

Operational issues occur at all levels of distance enterprises; local, state, national and international. Telecommunications and interactive delivery systems, for example, have the capability to bring the teacher directly to distance students, shrinking their world instantly (U. S. Congress, 1989). Connectivity with the magnitude to cross oceans, borders and lines forces issues at international and national levels as well as state and local levels (Collis, Veen, & De Vries, 1993; McGreal & Simand, 1992; Davis & Elliot 1989). It is the job of the various management and administrative bodies at each of those levels to consider the issues and construct policies designed to facilitate effective solutions which must evolve in concert with political and economic policy-making agendas (Olcott, 1992; Miller, 1991; Collis, Veen & De Vries, 1993).

Management and Administration

Rumble (1992) states that the key to successful management of distance education lies in planning, organization, leadership and control. "Management is the effective utilization of human and materials resources to achieve the objectives of an enterprise. Distance education systems, because of the inherent complexity and interdependence of their parts require 'tighter' management than conventional educational institutions" (Snowden & Daniel in Sewart, Keegan & Holmberg, 1988, p. 339).

The need for "tighter" management is valid in the sense that the administrative and management units of distance enterprises need to retain a higher degree of control and must possess a greater measure of knowledge pertaining to the inner workings of their organization than would normally be used in a non distance institution. The effective coordination of personnel at numerous levels and multiple sites requires excellent communication among all aspects of the enterprise (Davis & Elliott, 1989; Verduin & Clark, 1991).

Distance education enterprises, not unlike the highly specialized and multifaceted equipment of which they make use, are organizations with myriad interconnected parts. Each part of the distance education organization relies on excellent communications and appropriate control over the various organizational components in much the same way that the individual pieces of equipment require the smooth interconnectedness of their individual technological components in order to function at peak efficiency.

Due to the nature of their funding, the majority of distance education enterprises need to show a high degree of fiscal accountability (Snowden & Daniel in Sewart, Keegan & Holmberg, 1988; Murgatroyd & Woudstra, 1989). While price tags for the technology used in current distance systems involving computers and telecommunications networks are declining, the entry level costs for such equipment is seldom below the 6 figure mark and taxpayers, school boards, and state legislatures as well as funding agencies, both governmental and non-governmental, expect to get the most from their funds (Dede, 1990; Miller, 1991; Jones et al, 1992; U.S. Congress, 1989).

Indeed it would be highly irregular to find a distance education enterprise where some form of external funding was provided that did not require evidence that the monies were being effectively utilized. In situations such as the Mass Learn Pike where districts must buy-in to a system it would be highly unusual for participating school districts not to be concerned that fiscal accountability was a high priority of the administration and management of the distance system to which they subscribe (Miller, 1991; Davis & Elliott, 1989).

Issues pertaining to the means of visible measurement of achievement can be answered by comprehensive evaluations. Much of the evaluative procedure can be done by the management and administrative arm of the distance enterprise, however, evaluation should be done both internally and externally.

Evaluative feedback provides the mechanism by which distance education enterprises can demonstrate their effectiveness and assure the quality of the learning experiences they provide (Miller, 1991; Moore, 1989; Murgatroyd & Woudstra, 1989; U.S. Congress, 1989). Reilly & Gulliver (1992) stated:

> The distance learning experience, particularly when it involves the use of technology, cannot necessarily be evaluated by the standard measures applied to classroom education, such as seat time, amount of face-to-face contact with the instructor, and the immediate availability of massive library collections and extensive laboratory facilities. In fact, since measurement of these inputs has produced little empirical evidence of the effectiveness of conventional classroom learning, using them as the base line to evaluate distance learning is problematic as best. (p. 12)

Whether evaluations are being conducted within the distance organization or are facilitated by an external organization the criteria by which the evaluation is conducted will need to change in order to reflect the different pedagogical assumptions implicit in distance education (Granger in Reilly & Gulliver, 1992).

As distance education enterprises grow to meet the needs of their students they become increasingly complex. Technology has seen to it that education is no longer the sole territory or property of any one system, institution or governmental body (Reilly & Gulliver, 1992; U. S. Congress, 1989). The availability of information once thought of as accessible only to specific individuals or groups is now available to anyone with the equipment and desire to explore it.

The management and administrative bodies of many of today's distance enterprises reflect the increasingly complex nature of distance education's newer technologies. They are the product of a combination of organizations blended to form a single team with each player involved in specific aspects of the enterprise. It has recently become common practice for statewide networks to be the product of cooperation among the state's governmental body, the education system, at whatever levels necessary to accomplish the stated goals of the program, and the business sector (IDEA, 1992; Hezel, 1991; U.S. Congress 1989). Among the chief issues of administration and management is the need for cooperation among and between those entities involved in distance education (Reilly & Gulliver, 1992; Hezel, 1991; Miller, 1991).

Iowa's Star School Project, the Iowa Distance Education Alliance: Partnerships for Learning through Interactive Telecommunications, is an excellent example of the cooperative ideal. This project is the result of a collaborative effort of teachers and administrators from local school districts, the Iowa Department of Education, Iowa Public Television, the community colleges, the area education agencies, and the public (regent) and independent colleges and universities, and is supported by teaching and administrative professional organizations and the state's K-12 school boards (IDEA, 1992).

The Massachusetts Corporation for Educational Telecommunications (MECT) is similar in regard to the cooperation demonstrated by the business, labor, government, education and health sectors. This body boasts a Star Schools project which was the result of a partnership which coordinated 21 program providers (Miller, 1991).

The North Dakota Interactive Video Network, a statewide multiple video conferencing system, became a reality during the 1990-91 academic year through the cooperative efforts of their state legislature, the North Dakota University System, the Department of Public Instruction, the Information Services Division, the USDA Rural Health Project, the Educational Telecommunications Council (ETC), and local school districts (Tykwinski & Poulin, 1991).

In distance enterprises where instruction is telecast across state boundaries the issues of teacher certification and institution accreditation are a major concern (Hezel, 1991; Reilly & Guliver, 1992; U.S. Congress, 1989). Reilly and Gulliver (1992) listed the need for national accreditation, as called for by the Project of Assessing Long Distance Learning via Telecommunication (project ALLTELL), among the chief administrative and management issues in distance education.

Summary

Distance education enterprises are highly complex organizations. The issues concerning distance education enterprises are as complex as the enterprises themselves. In order to be successful, distance education enterprises require a high degree of planning, management control, and excellent communications.

The scope of these issues is wide ranging. These issues can be found within grade levels K - 12 and beyond, and course offerings across the curriculum. The issues concerning distance education enterprises involve both internal and external elements of the organization, recognize no geographical boundaries and can be found to occur at the local, state-wide, national and international levels.

Within the purview of management and administration there are issues arising from:

- the necessity for detailed program evaluations across all aspects of the distance enterprise conducted both internally and externally

- the desire for a set of nationally accepted institutional accreditation standards to insure the quality of an education delivered at a distance

- the desire for a nationally accepted set of teacher certification standards which meet a minimum criteria including training in distance education theory and methodology

- the necessity and desirability for cooperation among the business, government, and education sectors

Personnel Issues

Successful operation of a distance enterprise requires the knowledge, talents, and cooperation of a great number of individuals. John Dodd (in Kaye & Rumble, 1981) stated:

> In traditional teaching, not many people are involved in the teaching process. Teachers interact with students directly. Lecture notes are not professionally edited nor printed and distributed by others. The content of lecture notes is rarely scrutinized by academic colleagues. Teaching within the closed doors of the classroom is characteristically an individual, private activity.
>
> In distance teaching, communication between teachers and distance students is indirect. Many others--editors, designers, printers, broadcast producers, local tutor--can be involved in conveying to the student what the teacher originates. Teachers may work in production teams in which each member has an interest in what each other member is doing. With multiple learning materials being produced and many people collaborating in their production, the need to plan and coordinate staff activity is essential. (p. 85)

These individuals, from instructors to students to support staff, must work in concert to produce quality distance educational programming. Due to the interconnected nature of distance enterprises, each individual is considered a valuable and integral member of the distance education team (Cyrs & Smith, 1990; Duning, Van Kekerix, & Zaborowski, 1993; Kaye & Rumble, 1981; Verduin & Clark, 1991).

For the purpose of this discussion Personnel issues are divided into three areas: (a) teachers, (b) students, and (c) support staff. The teacher section includes issues in the areas of professional and pre-professional preparation, compensation, and support. The student section includes adult and K-12 learners and is divided into the areas of selection, preparation, support, and testing and evaluation. Support staff is divided into technical, clerical, and educational areas of expertise, and the position of facilitator / monitor. Each of these categories includes issues which must be resolved in order for the personnel of distance education enterprises to function effectively and efficiently.

Teachers

A number of critical issues concerning distance education teachers must be addressed, for while the goal of educating students has not changed, the methods of instruction require a new vision. This section includes issues which, by their very nature, may have the most far reaching impact if for no other reason than it is the teacher who teaches.

> The critical role of teachers in effective learning means that all must have training, preparation, and institutional support to successfully teach with technology....Few teachers have had either teacher education or field experiences that enable them to be effective distant teachers or successfully use technology in their own classroom. Although it is the technology that removes barriers and expands opportunities for learning, it is the teacher who teaches. In distance learning, teachers find that they are required to change their method of teaching and give more attention to advanced preparation, student interaction, visual materials, activities for independent study, and follow-up activities (U. S. Congress, 1989, p. 11).

For the purpose of this chapter we will delineate between the job responsibilities of the teacher and the facilitator/monitor. In many distance education enterprises the terms facilitator and monitor are used interchangeably, and in many cases facilitator/monitors are certified teachers. It will prove helpful, therefore, to provide a defined role for these positions.

The role of the teacher is that of delivering the instructional information to the student using some form of technology. The teacher must be certified for the appropriate grade level, possess the appropriate educational endorsements for specific subject matter, and have received training regarding effective distance education practices. The teacher is responsible for class content, design and delivery of instruction, degree of interactivity, and student evaluation at all receive sites as well as at the origination site.

The role of the facilitator/monitor is to perform functions involving operation of equipment, answering questions when necessary, distribution and collection of those materials which the teacher has chosen, assisting the course instructor when asked, and offering encouragement to remote site students.

Professional and Pre-professional Education

Effective distance education does not just happen any more than effective teachers just happen. Beaudoin (1990) stated that those faculty accustomed to more conventional teaching modes would have to acquire new skills to assume expanded roles not only to teach distance learners, but also to organize instructional resources suitable in content and format for independent study. The nature of distance education, i.e., the separation of teacher and learner, necessitates changes in the methods used for instructional delivery. Further, each technology used to deliver instruction, whether it be correspondence or interactive telecommunications, requires that modifications and enhancements be made to the traditional face-to-face methods of teaching (Cyrs & Smith, 1990; Dede, 1990).

Collis, Veen, & De Vries (1993) predict that there will be a great need for teachers and students with telecommunications literacy. In order for distance teachers to be effective they will need to participate in preparation programs designed to assist them in acquiring the necessary knowledge and skills required to function successfully in today's interactive distance education classrooms.

If those institutions which consider themselves to be at the forefront of preparing teachers for the classrooms of tomorrow wish to remain at the forefront of their profession they will need to provide their preservice and inservice teachers with the tools necessary to excel at their craft. While a large number of excellent institutions have been educating preservice and inservice teachers for decades, little has been done in the actual preparation of teachers for the world of distance education, (U.S. Congress, 1989). Even less preparation has been undertaken in the area of interactive distance delivery systems which involve telecommunications (Moore, 1989; U.S. Congress, 1989; McGreal & Simand, 1992). As distance education becomes increasing prevalent throughout the world the necessity of preparation in this area of the discipline will become more acute.

Iowa is an example of a state which is making efforts to address the training issue at both the preservice and inservice levels. In a cooperative effort, as part of the state's Star Schools Proposal, the Teacher Education Alliance (TEA) which is a part of the Iowa Distance Education Alliance (IDEA), is cooperating with the state's regent institutions and private colleges and universities to provide training and support to Iowa's preservice and inservice teachers.

The TEA is producing a resource guidebook for the infusion of distance education into existing teacher education programs which is designed to assist the state's teacher education professionals in preparing preservice teachers for success in the distance education classroom. The resource guide includes: (a) a discussion of the philosophy of distance education, (b) an infusion model, (c) a sample matrix of the process, (d) a discussion of learner characteristics, (e) a discussion of the organization involved in distance teaching, (f) a section concerning evaluation, and (g) a section covering copyright considerations.

In addition, the TEA is involved in the presentation of staff development workshops for the state's inservice teachers. The workshops for inservice teachers cover: (a) distance teaching methodology, (b) special curriculum needs, (c) design of instructional materials used in distance teaching, (d) development of curriculum implementation strategies, and (e) training and practice in the operation of the telecommunications system used to deliver instruction over the Iowa Communications Network (ICN).

In 1989 Mansfield University in Pennsylvania was providing education students in their instructional technologies course the opportunity to use audiographics technology to teach students in Riverdale, North Dakota (U.S. Congress, 1989). The Curry School of Education at the University of Virginia created an electronic bulletin board system called Teacher-LINK to connect student teachers in the field with their university professors (Schrum, 1991). These additions to student teaching and preservice teacher education offer students valuable experience in the capabilities and possibilities of distance teaching.

Many universities and colleges, New Mexico State University, Iowa State University, the University of Northern Iowa, North Dakota State, and Iowa's Kirkwood Community College among them, offer workshops in teleteaching for their faculty. These institutions have also developed extensive resource guidebooks to be used in preparing their faculty for successful distance teaching experiences (Cyrs & Smith, 1990; Graf, 1993; Tykwinski & Poulin, 1991). Such guidebooks typically include sections on distance teaching philosophy and methodology, audience characteristics, course and materials design, and technology operation and capability.

Where distance education courses cross state lines the certification of teachers becomes an issue (Hezel, 1991). The delivery of distance education would be greatly facilitated if states could reach a consensus related to the minimum standards which are required by those instructors teaching via telecommunications technology (U.S. Congress, 1989; Reilly & Gulliver, 1992).

Compensation Increasing demands are placed on instructors' time. Distance teachers need additional planning time and must adapt current materials or develop new ones with consideration for a new set of criteria (U.S. Congress, 1989; Cyrs & Smith, 1990; Graf, 1993). Issues concerning the ratio of planning time to teaching time will bear certain scrutiny and require implementation of policy as increasing numbers of teachers begin delivering instruction to students at a distance.

Where school districts participate in multiple site distance education delivery systems, issues pertaining to the sharing of teachers and their classes must be considered. Many of these issues are inherently local and need to be resolved between or among participating districts.

McGreal & Simand (1992) discussed the difficulties faced by Northern Ontario school districts attempting to use a cooperative model for distance education courses involving the sharing of services among several secondary schools. The authors pointed out that finding a mechanism for releasing the distance teachers, justifying small class sizes, and coordinating school calendars and teachers' schedules became a very complicated procedure. The authors found that when districts were attempting to form groups of more than three schools, problems increased exponentially. Their experience indicated that even groups of three were difficult to hold together.

Sachs, Wilkinson & Murphy (1993) described a highly successful instructor sharing agreement involving the campuses of the Virginia Community College System (VCCS). To facilitate the sharing of instructors the VCCS campuses which were receiving classes added each distance instructor as an adjunct faculty member. Each receive site campus collected enrollment fees from their students and paid an instructional delivery fee to the origination site campus. The origination site campus was solely responsible for paying the distance instructor.

Distance education is in a unique position to provide continuing education for inservice teachers. Districts which provide funds for the continuing education of their teachers and have distance education infrastructures in place will be able to provide those additional credits in a more cost effective manner. Travel time and expenses can be significantly reduced for teachers opting to take classes at a distance (Jurasek, 1993). Available courses are many and varied, offering educators across the nation opportunities to expand their knowledge base and create personal information networks.

However, questions of funding parity become evident as one moves from wealthy, influential districts, or those receiving substantial government funding, to those districts at the opposite end of the socio-economic and political spectrum.

> In this fee-for-service course delivery model, the users' fee justifies for the delivering board the outlay or resources. The receiving boards can participate in the courses as needed and opt only for courses that they cannot deliver locally. Unfortunately, it is often the smallest schools, those that need the courses most, that can least afford to pay for the courses; they need all their funds to maintain their in-school programs (McGreal & Simand, 1992, p. 58).

Depending on the availability of funds and the weight or importance assigned to distance education and its accompanying technology, money can be freed to defray all or part of the costs incurred by teachers who desire to participate in workshops and inservice programs concerning distance education (Willis, 1989). Policy needs to be designed to address equity of training opportunities for teachers already in the field.

Support Administrative and fiscal support for teachers will be required (U. S. Congress, 1989). Moore (1989) pointed out that in addition to appropriate training it was crucial for professional distance educators to receive administrative support that reflected a belief in the importance of efforts to become effective teachers-at-a-distance. He suggested that this could be accomplished by assurances of job security, salary and time allocations, and by including teachers in the areas of planning and decision making. Providing faculty with well maintained equipment and opportunities to become familiar with the technology, and staff development are equally important.

Students

It is traditional to think of adult learners when distance education is mentioned (Garrison, 1989). Indeed, the greatest percentage of distance students have been adults. Whole institutions of higher learning such as Athabasca University in Canada or Great Britain's Open University are dedicated to providing distance education at the post-secondary level.

That tradition is changing. With the implementation of well funded programs, such as the U.S. Federal government's Star Schools Program, the vast possibilities of distance learning are being increasingly offered to K-12 student populations as well as traditionally underserved populations (Miller, 1991; IDEA, 1993). High schools, middle schools, and even elementary schools are being offered opportunities to experience the wonder and power of today's high technology distance education.

Selection Traditionally distance students have been adults who voluntarily sought further education for a variety of reasons (Garrison, 1989). These students enrolled in educational programs which fit their individual needs and situations. Entrance to these programs was determined by the individual institution offering the course work. However, distance education is becoming a growing method for providing increased professional development. These corporate students are frequently selected for specific training by their superiors.

The major change in the distance educated student body is in the influx of classes being offered for students in grades K-12. At the elementary and middle school levels distance education, primarily in the form of telecommunications, is used as a method of curriculum enrichment. However, the impetus for distance learning at the secondary level is due primarily to the needs of small rural school districts (U.S. Congress, 1989). In some cases students enroll in courses to meet graduation requirements which their own districts are unable to offer. Other students opt to enroll in course work because they posses an interest in the subject or need the class for a college entrance requirement (Corporation for Public Broadcasting, 1993).

In many instances high school level students have been selected to attend distance classes by virtue of their high academic ability and specific learner characteristics, as is often the case with those students who have been labeled talented and gifted (U.S. Congress, 1989). At the other end of the spectrum are federally funded projects such as the Star Schools Programs whose goals include serving students and schools which are considered educationally disadvantaged or traditionally underserved (U.S. Congress, 1989; IDEA, 1993; Miller, 1991; Rumble, 1992).

Preparation Today's distance students can no longer be characterized by the sweeping generalities of the past. In an educational climate permeated by individualization, which distance education has always considered as one of its strengths, distance education is opening opportunities to whole classrooms of students.

Fiber optic technology makes it possible to place a teacher in real time both visually and auditorially within the receive site classroom; a technique referred to by one author as the next best thing to being there. Issues mentioned by Holmberg (1986) concerning the amount of individualization, student autonomy and opportunity for interaction become moot with the instructor "in-site". However, new issues arise to take their place.

Among those issues is the provision for a program of student orientation regarding the distance education experience (Moore, 1989). Students benefit from being informed about the rules and procedures of their distance class and the expectations of their instructor. Programs and personnel must exist that can explain and demonstrate the distance technology in those classrooms where some pieces of equipment, such as microphones, must be operated by students.

Support Appropriately designed and maintained support systems are a requirement for successful distance enterprises (Moore, 1989) Methods for accessing out of class materials, such as those provided by individual school media centers or local libraries, should be taken into consideration. For example, distance classes requiring specific laboratory facilities, such as a class in photography or computer programming, need to assist students in making the necessary arrangements for use of local facilities, either at the student's home school or in the local community, that can provide comparable experiences to those in their classes. If facilities are not locally available, arrangements should be made for student use of the facilities at the origination site.

Accessibility of the distance instructor is an important support issue. Students need to be apprised of the ways they can reach their teachers (Duning, Van Kekerix, & Zaborowski, 1993; Moore, 1989). This is usually done through the use of long distance phone calls or fax machine, however a block of time on the system could be provided at each site during a specific day when the instructor and student could "meet" via the technology. Trips by the instructor to the distance site as well as trips by the student to visit the instructor at the send site are also possibilities. Instructors need to provide their distance students with timely feedback concerning assignments and tests. Students must be constantly provided with opportunities to interact with their instructor, and fellow students at all participating sites and outside the distance classroom.

Distance students are separated from their instructor, classmates and the other personnel often associated with learning institutions. When problems occur these feelings of separation may become heightened. It is necessary, therefore, to provide distance students with counseling services that understand the special needs of distance students (Moore, 1989; U.S. Congress, 1989; Rumble, 1992).

Testing and Evaluation The term evaluation means many things to many people. In one form or another, evaluation is used in every kind of formal education (Verduin & Clark, 1991). It is important for students to participate in the evaluative process both in terms of their own progress and the success of the programs in which they participate.

Research shows that participant evaluation is one of the best indicators of the effectiveness of a program (Sachs, 1993). Student feedback can provide valuable data on which to base decisions regarding course effectiveness (Sachs, 1993; Johnson, 1988; Martin & Rainey, 1993). Once analyzed, assessments of student attitudes and perceptions can be used to identify and change those areas of a program that are found to produce negative reactions (Biner, 1993; Egan, Welch, Page & Sebastian, 1992).

Cyrs & Smith (1990) indicate that the purpose of student assessment either through observable performance, product development or traditional paper and pencil tests is to provide data to the instructor indicating to what degree the performance objectives have been mastered. Individual testing over course material is an important diagnostic tool for the student and the teacher. Students should be given timely feedback on the examinations they take in their distance classes (Duning, Van Kekerix, & Zaborowski, 1993).

Support Staff

Distance education enterprises are characterized by the integration of a great many parts working toward a common goal. Support personnel, clerical, technical, and educational, are a vital link between teacher and student. Support staff provide a great deal of the services used by distance students.

Technical personnel The focus on technologically advanced telecommunications systems as the method of delivery of distance education necessitates a staff of well trained individuals. In some distance classrooms the technology that delivers the picture and sound to the remote sites is run by a technician rather than the distance teacher. School district remote sites with large investments in advanced technology require access to the services of local technical support personnel.

Clerical personnel Clerical personnel handle enrollment and registration of students, process requests for equipment repair and acquisition, handle collection of tuition, maintain lines of communication between and among the various teams involved in distance enterprises, and frequently assist in the replication and distribution of course materials. As a main factor in the service oriented arm of a distance enterprise these individuals have a great deal of contact with distance students. When handling routine student transactions on a daily basis, friendliness and a helpful attitude make support staff a critical link between the student and the enterprise.

Educational personnel A number of issues surround the role of the facilitator / monitor. Policies differ from state to state as to whether or not the facilitator / monitor must be present at the receive site during the entire class period or simply accessible to students if and when they require assistance. States also vary widely on the specific qualifications required for this position. The necessity for current teaching certification for facilitators is directly affected by the way in which individual states interpret their policies governing the use of distance site facilitators. Training in effective distance practices may also be required depending upon the state.

The state of Washington requires classroom facilitators to be certified in the subject being taught. States such as Alaska and Oregon require the presence of certified teachers, however endorsement for specific subject matter is not considered necessary (US. Congress 1989). The most current revision in the Iowa Code Chapter 15, "Use of Telecommunication for Instruction by Schools" 281-15.5(256) Teacher preparation and accessibility reads,

> A teacher appropriately licensed and endorsed for the educational level and content area being taught shall be present and responsible for the instructional program at the receiving site if a presenter of material transmitted via telecommunications is not an appropriately licensed and endorsed teacher for the educational level and content area. If a presenter of material transmitted via telecommunications is an appropriately licensed and endorsed teacher for the educational level and content area, a supervising teacher, or aide to whom a supervising teacher is readily available for consultation, shall supervise and monitor the curriculum and students, and be readily accessible to the students. Prior to being assigned initially to deliver instruction via

> telecommunications, a teacher shall receive training regarding effective practices which enhance learning by telecommunications." (Iowa Department of Education, 1993).

Programming Issues

Courses

Distance education courses are designed to accommodate vast and varied segments of the population including business, professional organizations, government, and education. Courses are offered in a multitude of subjects across the curriculum and more recently across grade levels, spanning everything from pre-school to post-secondary education. Programming is available in every possible media from print to live, two-way full motion interactive video. Classes are available locally, regionally, nationally, and internationally.

The issue is no longer so much a profound concern over programming subject availability, accessibility, or cost, but one of quality. Hezel (1991) points to educational value as being an important consideration in a program or course. In looking for programming to suit the needs of a particular group of learners it becomes imperative to look beyond the titles and price tags. School districts have little money to waste on programming that is pedagogically unsound, poorly designed, or unsuitable to their specific needs.

Miller (1991), discussing distance education, states that there are no national guidelines or articulated standards for academic courses, and further that there are no generally accepted criteria or review panels for instructional design and delivery. Such a lack of policy concerning distance programming surrounds this area of concern with the distinct air of caveat emptor.

Course design and curriculum development are critical to any educational endeavor, but the special parameters presented by distance education make this area particularly important (Moore, 1989; Graf, 1993). In a large dedicated distance education enterprise the personnel required for course and curriculum design can be numerous. Verduin and Clark, (1991) stated,

> The development of learning materials and media is particularly critical in distance education and could be approached by a team with a good degree of sophistication. The development team should include content specialists (academics); instructional designers; writers and editors; media specialists, if different from designers; and specialists in adult learner behavior and curriculum development. An interactive team approach can minimize the production-line concept, in which people add bits and pieces to courses as they come down the line. Course development is a highly skilled area of expertise and should be treated as such to ensure quality control of the program. (p. 177)

Depending upon the size of the distance enterprise and the level at which the course is taught, the content of the material and the extent of the production will vary. Dedicated distance universities such as Great Britain's Open University require vast design and production services. Programming originating from a single instructor in an Iowa high school may simply need to be adapted to the specific delivery format which will be used.

There are currently a number of privately and commercially produced shows available. Programs produced for the lower elementary level, like "Reading Rainbow", delight students and teachers alike. Current events programming such as The Discovery Channel's "Assignment Discovery", Cable News Network's (CNN) production "CNN Newsroom", and Whittle Communication's "Channel One" provide older students with excellent news coverage. Such programming is not without its pitfalls however. In the case of "Channel One" there is advertising to consider and this has become a controversial issue in the educational community (U.S. Congress, 1989; Miller 1991).

Intellectual property rights of faculty and questions concerning faculty royalties will need to be addressed (Hezel, 1991; Miller, 1991). Programming copyright policies must be fashioned that are equitable to the developer without pricing the product beyond the means of the distance enterprise. Marketing the instructional programming available from various distance institutions will need to be addressed (Moore 1989; Rumble, 1992).

Programming control is a vital issue. Miller (1991) points to MCET's Star School proposal as an example of making an attempt to accommodate local autonomy by presenting an array of available programs and technologies and assisting local schools in making the most suitable choices. It is an important consideration to local communities to be able to retain control over the programming they use (Miller, 1991; IDEA, 1993; McGreal & Simand, 1992)

Enrichment

One of the advantages of distance education, particularly in the area of telecommunications, is the multitude of ways in which it can be used to enrich the curriculum. Through the use of current technology it is possible to bring experiences into the classroom that were only dreamed of a few years ago.

Children in a sixth grade social studies class writing to pen-pals in a foreign country are able to converse with their fellow students face-to-face via telecommunications. Students in a high school civics class studying famous speeches from national political conventions could talk with individuals who have delivered such addresses. Students in a foreign language classroom can exchange in lively conversation directly with their counterparts in a classroom in Spain. Recently 15 sites in Iowa participated in special All State instrumental music lessons where high school students across Iowa were given the opportunity to learn and interact with experts in the fields of brass, reeds and percussion. As part of the education process student teachers from several universities across the nation can gather to discuss the first several weeks of their teaching experience.

Facilities Issues

Equipment and Maintenance

Technology that is new today is old tomorrow. Computer and telecommunications equipment undergo changes in capability with such speed that some of the technology becomes obsolete almost before it is operational (Miller, 1991). When the concerns of obsolescence are coupled with the rate at which technology drops in price and the issues of which technology to buy and how much should be purchased, it is clear that there are difficult questions for distance enterprises and school districts to answer (Dede, 1990; U.S. Congress, 1989).

The amount and sophistication of the equipment needed for a distance education enterprise depends on the chosen method of delivery, or the type of system to which one subscribes. Each enterprise is organized and funded differently. Equity in the distribution of funding is a concern (McGreal & Simand, 1992). The purchase of equipment is usually centrally done so that equipment can be purchased in volume which is more cost effective.

Space for distance classrooms becomes an issue particularly in overcrowded districts. Lack of an adequate site for a distance classroom could mean a lack of participation in a distance project and would have to be carefully weighed against the commotion created by displacing and subsequently redistributing students in order to gain the required space. Consideration must be given to equipping interactive distance classrooms in the most unobtrusive way possible. The learning, not the technology, should be the primary focus of what transpires in the distance education classroom (Miller, 1991).

Maintenance of interactive distance classrooms is generally taken for granted, but left undone, this aspect of a distance classroom could well be the most glaring weakness. The majority of complaints from distance students concerning telecourses relate to the quality of the transmissions (Cyrs & Smith, 1990; Jurasek, 1993).

Scheduling

Assessments of the needs of distance students can help determine which courses to schedule during a semester; however, when classes are telecast to multiple sites, the problems associated with scheduling multiply rapidly. Schedules need to be synchronized between and among participating districts not only in regard to their daily calendar but the yearly calendar as well (McGreal & Simand, 1992).

Policy must be formulated regarding issues of scheduling conflicts. A criterion for resolving those conflicts should be established and a position among the personnel of the distance enterprise should be designated to make those kinds of decisions. In Iowa, when scheduling conflicts on the Iowa Communications Network cannot be resolved at the regional level, the matter is turned over to the Narrowcast Advisory Committee (NAC) which renders a resolution.

Class size is an issue that can affect course offerings. Some districts simply cannot afford to commit a classroom or the services of a distance teacher for one period each day for an entire semester for a very small number of students (McGreal & Simand, 1992). Conversely, extremely large numbers of students as well as large numbers of multiple sites make distance classes undesirable because the amount of interactivity is severely curtailed (U.S. Congress, 1989).

In an effort to reach out to community interests and make distance education available to populations which are not a part of the traditional academic setting, distance sites located in school buildings must make an effort to remain accessible during the hours when classes are not in session. Conversely, those distance sites which are located in places other than the traditional educational setting need to be sensitive to the needs of the educational community. Clearly, such awareness can build invaluable partnerships which will enrich all involved.

Summary

This chapter has discussed issues pertaining to the organization and operation of distance education enterprises. As distance education enterprises break through the barriers of traditional classroom walls they encounter new barriers with which they must contend. If distance classrooms are to become places of learning excellence the issues which erect new barriers will need to be addressed.

Distance education literature dealing with policy issues can be summarized as follows:

1. To be successful distance educators, preservice and inservice teachers require additional training appropriate to their mission.

2. Delivery of distance education courses spanning state boundaries will be greatly facilitated by a nationally agreed upon set of standards.

3. Administrative and fiscal support for distance teachers is required and can be demonstrated by providing for staff development and increased planning time, inclusion in the policy planning procedure, job security, and well maintained equipment.

4. Inequities in funding of programs for staff development and student programming must be addressed.

5. Sharing of instructors and scheduling of courses between or among school systems requires meticulous planning.

6. Students must be provided with support services including orientation and counseling appropriate to their grade level and course of study.

7. Testing and evaluation of both student performance and program effectiveness are necessary and such feedback should be expeditious.

8. Programming, while widely available in many formats, curriculum areas, and grade levels does not necessarily meet a minimum standard of excellence and should be judged accordingly.

9. There are a plethora of technologies available for the delivery of distance education. However, compatibility, cost, and longevity of equipment require careful consideration and planning prior to purchase and installation.

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SECTION III - RESEARCH PROJECT RESULTS

Teachers' Training in Distance Education and Their Willingness to use the Technology After the Completion of Inservice Training

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Education is changing. A paradigm shift has occurred within education as the world has moved from the industrial age to the information age (Reigeluth, 1994; Toffler, 1990). This shift has provided educators with technological innovations that have created new environments of teaching and learning. Environments that no longer support the "assembly line" view of industrialized education. Reigeluth (1994) describes industrialized education as education which treats all students the same; all students are expected to do the same thing at the same time. This sameness forces students to be passive learners and passive members of their school community. Information age education can create environment that see the student as an active participant in the construction of new knowledge. Technology offers an empowering environment for meeting the needs of the students in this new age. Empowering environments that offer a chance for active student-constructed learning and adventurous risk-taking teaching (Dede, 1990; Sheingold, 1990).

Distance education technology offers a robust opportunity for the creation of empowering environments. It is what Zuccermaglio (1993) describes as an "empty or open" not a "full" technology. Full technology is designed to transfer information from the machine to the learner while empty technology offers the opportunity for metacognition and reflection of the learning activity. Distance education as "empty" technology can be used to develop transferable cognitive abilities, not simply more efficient recall of prescribed information. It maximizes communication--not isolation (Garrison, 1993). Distance learning environments offer opportunities for local and long distance collaboration, increased communication between students and teachers, access to the larger global community, and access to "others'" views of the world (Sheingold, 1990). However, these opportunities will not occur vicariously. Planning, training, and experience must be provided if the potential of distance education is to be reached.

Teacher Training and Distance Education

Distance education cannot succeed with inadequately trained or uncommitted teachers. Staff development is critical for the implementation of new programs and teaching methods (Strudler, 1993). If teachers are to use this technology in their classrooms, their need for adequate inservice training programs must be met. Brown, Collins, and Duguid (1989) remind us it is quite possible to acquire a tool but to be unable to use it. For effective usage, many suggestions are provided in the literature concerning teachers' inservice training. Darling-Hammond (1993) posits that to create training programs which change the way people do things, a strong foundation must be built for professional development training and support. Strudler (1993) supports this idea and states:

> any training and staff development plan for technology must address the broader goal of empowering teachers and students to use information technology as tools throughout the curriculum. It is essential that staff development plans address the broader professional need of teachers (p.8).

An understanding of the keys to successful inservice is essential if an innovation is to be implemented to its full potential.

Sustained interaction and staff development are crucial for any educational change. However, the more complex the change, the more interaction is required to assure implementation (Fullan, 1991). Within inservice training, teachers must be educated about the relationship between learning and technology, how to facilitate interactivity, and how to operate the technology (Corporation for Public Broadcasting, 1993; Dede, 1990). Support following training is seen as necessary for effective staff development. Follow-up support assists teachers in transferring newly learned skills and practices into their active teaching repertoire (Joyce, 1990; Joyce & Showers, 1988). The Rand Change Agent Study found that even quality innovations could not succeed if teachers were inadequately trained (Berman & MacLauglin, 1977). The quality of the teacher training remains the key to the successful implementation of any new innovation.

Distance Education in Iowa

Distance education using the Iowa Communications Network (ICN) is one form of technology that has been introduced recently in Iowa. The ICN is a state wide two-way full motion interactive fiber-optic telecommunications network with a point of presence (classroom) in each of Iowa's 99 counties. The ICN links colleges, universities and secondary schools throughout the state. This network will be used to offer new and additional courses to schools and students (IDEA, 1992).

Iowa's vision of distance education is built around the concept of enhancing the quality of education through the use of telecommunications. The ICN combines the use of fiber optic networks, multimedia, and computers to mediate cognitive interactions with the environment. It offers the opportunity to present life contexts that change views of working, thinking, and learning. The technology is not seen as a replacement of the teacher but as a tool that mediates between the student, teacher, and the object of knowledge (Zuccermaglio, 1993). The appropriate use of distance education will encourage and challenge learners to construct their own meaning and to create new knowledge. To reach this goal, teachers must be willing to adopt the use of the technology. An understanding of the factors that contribute to teachers' willingness to use the innovation can be studied through the use of Rogers' (1983) Classical Diffusion Model.

Classical Diffusion Model

Diffusion of innovations is a multidisciplinary theory of planned social change that has brought about the spread of new ideas or new technologies through out a social system. Rogers (1983) defined diffusion as "the process by which an innovation is communicated through certain channels, over time, among members of a social system" (p. 5). Innovations are adopted at different rates depending on how they are perceived by adopters. There are five characteristics of innovations that influence that decision. These include relative advantage, compatibility, complexity, trialability, and observability. Rogers (1983) notes that relative advantage is the degree to which an adopter perceives an innovation as an advantage. The greater the perceived advantage, the faster the innovation will be adopted. The compatibility of an innovation with the existing culture and its ability to meet felt need, will also influence its rate of adoption. Innovations seen as compatible with the existing values of a social system will be adopted faster than those that are not perceived as being compatible . The complexity of the innovation is another characteristic that influences the rate of adoption. If an innovation is perceived as being complex to use or understand it will not be adopted as quickly. Trialability is the opportunity for trying out the new innovation to see if it meets the adopters' needs. Perceived trialability of an innovation is positively related to its rate of adoption. Observability is the degree to which the results of an innovation are observable to others. The degree to which these results can be seen, the higher the rate of adoption (Rogers, 1983).

Diffusion is defined as a particular type of communication where one person offers information to others about a new idea. The communication channel is the method by which the message is conveyed. Interpersonal channels involves face to face exchange and are more effective in the adoption process. Most adopters make their decision to adopt based on an interpersonal subjective evaluation rather than a scientific evaluation. Thus the use of these channels will influence the process of adoption (Rogers, 1983).

Rogers proposes a (5) stage model of the adoption process which consists of knowledge, persuasion, decision, implementation, and confirmation. This study was not conducted to see if the stages of the innovation-decision-process exist. The researchers are using the constructs of knowledge, persuasion, and decision to understand the symbolic adoption of the Iowa Communication Network. Knowledge is defined as an individual's exposure to the innovation's existence and gaining of understanding its functions. Persuasion is the individual's formation of a favorable attitude toward the innovation. Decision is the individual's engagement in activities that lead to a choice to adopt or reject the innovation (Rogers, 1983).

Few studies have looked at the inservice training from a diffusion innovation point of view. Moore and Thompson (1990) posit that it is important to "review the extent and quality of teacher preparation and in-service training in distance education" if we are indeed to understand the process of change (p. 37). Many factors contribute to teachers' decision to adopt an innovation.

The Study

This study will focus on teachers' inservice training and its relationship to their willingness to use an innovation such as distance education. The study will provide information for follow-up training activities and insight into the process of adoption as a whole.

The main objectives of this study were:

1. Identification of the factors that contribute to the teachers' willingness to teach over the ICN after the completion of the distance education inservice training.

2. Examination of the relationship between teacher attendance in either the workshop or the institute or attendance in both, and factors that contribute to their willingness to teach over the ICN.

3. Examination of the relationship between participants decision to attend the Workshop and/or the Institute and the participant's knowledge about distance education, their attitude towards distance education and their willingness to teach over the ICN.

Methodology

Subjects

The subjects of this study were all participants who attended the 16 Inservice Workshops and the five Curriculum Institutes in the Spring, Summer, and Fall of 1993. There were 475 teachers and administrators surveyed. Of the 280 survey respondents, 210 K-12 teachers were studied.

Instrument

The instrument was developed after the examination of other diffusion of innovation and technology instruments (Carr, 1990, Derr, 1991). It was piloted for readability in two graduate technology courses.

The instrument consisted of four parts: demographic questions, perceptions about distance education in relation to knowledge, attitude (persuasion), willingness to adopt (decision), and communication channels. Additionally, some general questions were asked concerning each teacher's personal use of the ICN and factors that would increase the probability of their use of the ICN.

The demographic variables included in the survey were gender, age, area of instruction, highest degree, teaching experience, level of experience in using distance education. Participants' perceptions about their knowledge, attitude, and willingness to adopt distance education were measured by using a five-point strongly disagree/strongly agree scale. Knowledge was measured directly by asking participants to respond to the following question "I believe I am knowledgeable about teaching at a distance". Attitudes towards the teaching at a distance were measured directly by asking respondents to respond to this item "I believe I have a favorable attitude towards teaching at a distance". The same construct was measured indirectly using Rogers' (1983) taxonomy of the perceived characteristics of the innovation. These include relative advantage, complexity, compatibility, trialability and observability. The coefficient alpha reliability for the attitude scale was .88. Finally, willingness to teach over the ICN was measured directly using this item "I am willing to teach over the ICN".

Procedures and Data Analysis

The instrument was mailed to distance education workshop and institute participants after inservice completion followed by a reminder postcard. A return rate of 61 percent was obtained. Results were analyzed using the statistical package for Social Sciences (SPSS). Statistics computed were descriptive statistics, stepwise regression, and one-way ANOVA.

Results

Demographic Characteristics

Demographic characteristics of participants are presented in Table 1. . One hundred twelve were female teachers (53 percent) and 98 (47 percent) were male teachers. Two thirds of the teachers were aged 40 or more. One hundred forty two (68 percent) teachers had more than 15 years of teaching experience. Most teachers (70 percent) had no experience or have little experience using distance education technologies. Seventy-one (34 percent) teachers attended the inservice workshops, 53 (26 percent) teachers attended the curriculum institutes, and 83 (40 percent) attended both. The three groups were the main focus of the statistical analysis.

Predicting Factors of Willingness to use the ICN

Stepwise regression (at the .05) level was selected to analyze this portion of the data (Borg & Gall, 1989). It was used to identify the predictors of teachers' willingness to teach over the ICN . The independent variables used for this analysis were: 1) knowledge about distance education, 2) general attitude score about distance education, 3) sex, 4) age, 5) communication with other teachers and 6) the school being connected to the ICN. Favorable attitude towards distance education was the primary predictor variable for all three groups (workshop participants, institute participants, and those who attended both). In addition to attitude, teachers' positive conversation with others about distance education predicted curriculum institute teachers' willingness to teach over the ICN.

Inservice Attendance

One-way ANOVA (at the .05) level was used to identify whether there is a significant difference between teachers attending singularly the workshop or institute or attendance at both in their perception of knowledge, attitude, and willingness to teach over the ICN.

The results showed a significant difference between those who attended the workshop or curriculum institute and those who attended both the workshop and the curriculum institute (F=8.09, P<.001) in their knowledge about distance education (see Table 2). Using Scheffe at the .05 level there was a difference between attendance at both the workshop and the institute and attendance at only the institute in their perception of their knowledge about distance education. The knowledge score for those who attended both the workshop and the institute was higher than for those who attended only the Institute.

In terms of attitudes towards distance education, the results showed no significant difference between the three groups (F=2.02, P=.14). Teachers' attitude scores were similar in the three groups.

The results showed a significant difference between the three groups in their willingness to use distance education (F=4.73, P<.001) (Table 3). Scheffe analysis showed a difference between those who attended both the workshop and the institute and those who attended either the workshop or the institute. Those who attended both the inservices showed more willingness to teach over the ICN than those who attended only one inservice.

Reason for Attending

Respondents were asked what most influenced their decision to attend the inservice(s). Their answers were classified into three categories: personal interest, administrative request, or other reasons. A One-way ANOVA was used to determine if there was a significant difference between the three groups in relation to knowledge, attitude and willingness to teach over the ICN.

The results showed no statistical difference between teachers who joined the inservice for personal interest, administrative request and for other reasons in their knowledge about distance education (F=0.80, p=0.45). This means that the reason for attending the inservice(s) did not affect the knowledge gained.

The ANOVA results showed a statistical difference between the three groups in their attitude towards distance education (F=4.56, p=0.01). Using Scheffe, there was a difference between those teachers who joined the inservices for personal interest and those who joined because of administrative request. Those reporting personal interest showed more favorable attitude toward distance education than those attending because of an administrative request.

A statistical difference between the three groups was identified in relation to willingness to use the ICN (F=3.16, p=0.045). Scheffe analysis, however, did not detect any difference between those teachers who attended for personal interest, administrative request or attended for other reasons. Although the mean score for teachers who attended for personal interest or other reasons was higher than those who attended because of an administrative request. Perhaps, a more liberal test such as Tukey would detect such a difference.

Discussion

Rogers' presents a model of the innovation decision process. This study has focused on the three stages of that model (knowledge, persuasion and decision) in conjunction with the willingness to adopt a distance education technology. Inservice training in distance education serves as the major vehicle for transmitting information and skills to teachers. This study focused on factors that contribute to teachers' willingness to use the technology. The inservices provide teachers with the knowledge which corresponds to the first stage of the model. According to Rogers (1983) the second stage of persuasion can be addressed through the study of attitudes. An innovation will have a greater chance of being accepted if individuals form positive attitudes toward the innovation. Inservice training provides an environment that can facilitate this process. This study identified that attitudes toward the innovation are the primary predictor of teachers' willingness to use distance education. Those teachers who formed positive attitudes toward distance education, showed more willingness to use the technology.

Teachers who attended both inservices showed more knowledge and more willingness to use distance education than those who attended only one inservice. This implies that teachers need more than a "one shot workshop" to adopt new educational technologies (Huberman & Miles, 1984; Hurst ,1994; Stallings, 1989). Follow-up experiences are important to support the trainees as they move toward adoption.

Teachers who attended the inservices for personal interest showed more favorable attitude toward the use of distance education and more willingness to use distance education. It must not be assumed that all teachers came to the inservices with the same level of interest in learning about the technology. Therefore, inservice coordinators should include a variety of experiences and viewpoints to address the beliefs and knowledge levels of the participants. In addition, time should be provided for input from the attendees to help tailor the inservices to the their needs.

Education is in a state of change, change in curriculum, class structure and staff development. Changes in teaching practices involve the development of new skills, behaviors, coordinated activities, and technologies (Fullan, 1987). One of the methods Iowa chose to address change in education was the creation of the ICN. This change can only occur if Iowa teachers are willing to use the technology. This study has identified that teachers' positive attitudes toward use of the ICN was a major contributor to the adoption decision. Additionally, follow-up activities and participant's personal interest influenced the decision.

In conclusion, several implications concerning distance education inservice construction can be drawn from this study. First, inservice developers should provide the opportunity for attendees to discuss their concerns, questions, and beliefs toward the technology. Second, planned follow-up activities should be part of the staff development process. Finally, inservice developers should take into consideration the attendees' needs and reasons for attending the inservice to increase participants' willingness to use the technology.

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Table 1. Characteristics of workshop/institute participants

	N	%
Sex:		
Females	112	53.3
Males	98	46.7
Attended:		
Inservice workshop	71	34
Curriculum institute	53	26
Both	83	40
Age:		
40 and less	61	29
Greater than 40	148	71
Area:		
Foreign Language	29	14
Literacy	23	11
Math	62	30
Science	35	17
Vocational Education	27	13
Elementary	8	4
Other	20	10
Teaching Experience:		
15 and less	67	32
Greater than 15	142	68
Level of experience using distance education:		
No experience	60	29
Very little	85	41
Some	58	28
Quite a bit	4	2
Extensive	2	1

Table 2. ANOVA results of teachers' perception of their knowledge about distance and their attendance at Workshops and Institutes.

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Probability
Between Groups	2	10.23	5.12	8.92	0.001
Within Groups	205	129.60	0.63		
Total	207	139.83			

Table 3. ANOVA results of teachers' willingness to teach over the ICN and their attendance at Workshops and Institutes.

Source	D.F.	Sum of Squares	Mean Squares	F Ratio	F Probability
Between Groups	2	5.33	2.77	4.74	0.001
Within Groups	205	119.70	0.59		
Total	207	125.23			

A Study of the Effect of Network Communication and Distance Education on Preservice Teachers' Interaction With Middle School Students

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"By communicating with the eighth grade class, it brought in a realistic perspective that I could tie in with all my theory content methods classes. It helped bring everything together in a whole new context that was alive and real."

The above quotation is from a response paper of a preservice teacher in the College of Education at Iowa State who participated in the research study that used computer telecommunications (Internet) and the Iowa Communications Network (ICN) to link college students and middle school students. This research study examined the effect of the online and distance education environment on the attitude of preservice teachers on their perceived ability to interact with middle school students and the frequency and type of messages they communicated. The communication link between the eighth grade and the preservice college students was achieved using Internet and the Iowa communications fiber optics distance education classrooms at Hawkeye Community College and Iowa State University (ISU).

The main objective of this study was to determine how the experience of online and interactive television communication would affect the preservice teachers' attitudes toward interacting with middle school students. To measure the results of this experience, an attitudinal survey instrument was developed to determine attitudes of the preservice teachers, the written online communications were evaluated for increased awareness by the preservice teacher of the abilities and problems of eighth grade students and response papers written by the students were analyzed.

Background

Research in written language acquisition suggests that young writers who are developing their language skills need a classroom environment that encourages language as a process and as a form of communication to create meaning (Farr, 1985; Hawkins & Sheingold, 1986). Evidence suggests that computer technology can be a tool to create this learning environment and assist in teaching language acquisitions skills (Diaute, 1985; Papert, 1980).

The creation of a functional writing environment (Newman, 1987; Riel, 1991) which includes word processing, social interaction, and telecommunication networks may be the combination that will create authentic literacy events that will motivate students to use written language. Text-based communication that is computer-mediated is interactive and requires active involvement of the participants (Harasim, 1990). This new language environment that uses online and distance education will allow students to communicate with readers who are different in age, background, and education (Riel, 1991).

The early contact experiences that preservice teachers have with schools need to be reflective and under the auspices of their college instructor according to Goodman (1986). Many early field experiences may have benefits in subsequent course work as well as self analyzed and perceived benefits (Denton, 1982).

Beginning teachers often complain that they feel unprepared for the challenges they face in their first classrooms. Increasing the student contact time in preservice education curriculum should serve to increase the confidence level of new teachers. The utilization of online networks and distance education classrooms is a very feasible, cost effective way to increase preservice teacher/student contact time.

The ability of preservice secondary teachers to interact with middle school students using online networks and interactive television suggests that this technology allowed them to evaluate and learn what students at this age read and write about. The technology allowed a one-to-one interactive arrangement, and gave them a chance to understand the student they were paired with and to follow their development and growth as readers and writers throughout the semester.

It was hypothesized that this experience would increase the capability of preservice teachers to interact with middle school students and would expand their knowledge of what students that age enjoy reading and writing about and develop confidence in their ability to assess and influence the language development of this age student. The second hypothesis was that the college students would utilize technology and feel competent communicating with middle school students in the role of a preservice teacher.

Description of the Study

The purpose of this research study was to acquire knowledge of preservice teachers' attitudes toward technology and toward teaching middle school students. The objective was to determine if the communications network and interactive television experience could create an authentic learning activity that would motivate the preservice teachers to use the technology and to understand and appreciate the middle school age students.

The participants were 55 preservice education students enrolled in "Teaching Reading in the Secondary Schools" in the fall and spring semesters at Iowa State. The fall semester had 27 students involved and the spring had 28. The study measured the number of exchanges, as well as, the length and the nature of the written exchange initiated by the college students. The ICN meetings were also examined and observations made as to level of anxiety and amount of participation of students. A pre- and posttest attitude survey questionnaire (Appendix I) was used to measure perceived change in knowledge about middle school students and their language skills. The objective for the college students was to increase their confidence level in using technology and in working with middle school students. The information provided from these sources should add to our understanding of how we can incorporate distance education into the college education class.

Research Procedures

Permission was obtained from the Iowa State University Human Subjects Committee to conduct the study. Iowa State students acquired an internet account and an e-mail address during the first week in each semester.

During the first phase, the online network communication was established between the two schools. All ISU students received their e-mail address and made the initial contact with their assigned computer pal by sending an informal message where they described themselves and asked questions for the eighth to respond to. During the initial phase, photographs were taken of each student to exchange with their assigned computer pal before the meeting using the ICN distance education classrooms.

The eighth graders and the college students had two meetings in the semester using the ICN classroom. The first meeting occurred in the third week of the college semester and the last meeting in the last week of classes. The online ICN meetings were one hour in duration with the first meeting used to introduce the students to each other and to find out about personal backgrounds, school and reading interests. The last ICN meeting was more focused with the eight graders asking the college students about college life. The college students formed five panels of four each and took a ten minute time at the "controls."

Results

The major factors of interest were whether or not the preservice students would see the potential and utilize the opportunity to interact with middle school students using electronic mail and the interactive televised meetings. Overall this experience seemed to have contributed to a change in the preservice teachers' perceptions of students in this age group and it was viewed as a positive experience by most of the students. Due to several delays and problems in the first semester, this report will focus on the results from the second semester.

There were 28 students, 11 males and 17 females who participated throughout the second semester exchange. The study analyzed the number of e-mail messages sent by each student and tone of the message as to the voice of the author. The students also wrote responses to the daily experiences and a final paper to summarize their attitude toward the experience including the two ICN meetings with the middle school students.

There were a total of 152 messages sent by the 28 students. With an average of 5.42 messages per student sent. The range was from a low of 1 to a high of 13 over the 12 weeks of the spring semester. The most often occurring frequency was 8.

The tone or stance of the messages were classified as to "friend", "teacher", "teacher/friend", or "critic". Eleven of the 28 students used a teacher/friend stance. They seemed to relate as an older adult and saw themselves in the role of "teacher". Eleven of the 28 combined the role of teacher and friend asking and responding to questions on a personal and intimate level and moving back to the teacher role.

The two extremes were the two students who related only as a friend or "sister" as they described the experience. One of these pairs began to write to each other outside the classroom and the reports indicated that serious adolescent problems were discussed. The other extreme was three students who did not seem to be able to relate to this age student at all. They remained distant and the exchanges were very formal and stilted. One student had only one exchange and was not included.

The study also used a questionnaire to determine if there were changes in how the students perceived their knowledge and confidence level on sending e-mail messages, understanding the reading and writing interest of middle school students. Nineteen students completed both the surveys. The survey included 14 items that students responded to on a Likert scale of 1 to 5, with 1 being not knowledgeable and 5 being very knowledgeable. The difference in the means of four of the representative items is reported in Table 1.

Twenty-seven of the 28 students wrote a final reflective paper explaining their reaction and analysis of the experience. Of these reports, 23 analyses were positive or very positive and 4 defined it as a negative experience.

The following quotes are taken from these written reports and exemplifies the general assessment of the project:

"Both the writing and the meetings over the ICN were helpful experiences to prepare me for future teaching. The writing let me get back into the mind of an eighth grader."

"The ICN meetings were a lot of fun. Being able to see and talk to the person you're writing to makes corresponding much more easy. The second meeting was unbelievable! The students opened up so much compared to the first time."

"Overall, I thought this was an excellent opportunity to learn about new technology and about junior high all at once. The correspondence was a lot of fun and very worthwhile."

"My experience with the computer pal was very helpful. It gave me a chance to see an eighth-grader progress throughout a semester."

"I was sure that I never wanted to teach junior high level kids. I had convinced myself that they would be too immature, and that they would drive me crazy. After taking part in this exchange however, I have seen that they are really a good group of kids to work with. They seem motivated and excited to learn, and they are a lot more mature than I previously thought. I am now thinking twice about getting into this age level of teaching."

Conclusion

This study attempted to create an opportunity for the preservice teacher to interact with middle school students to observe their reading, writing, and communication skills. They were able to follow them through fourteen weeks of the school year. One of the most common comments in the written responses was "I had forgotten what it was like to be in the eighth grade."

The use of the ICN at the beginning and end of the semester allowed the students to observe the change in behavior of a group of eighth graders after a period of time. Some of the comments made about the level of activity and excitement of this age student indicate that the students had a new awareness and appreciation for this age student.

The results of the attitude survey indicate that there was a positive change in both the ability to utilize technology tools and in assessing the needs of eighth graders as readers and writers. These findings suggests preservice teachers can benefit from experiences with students when there is focused direction with the contact and time for reflection by the student.

The results of this research should contribute to the knowledge of how online communication and distance education can be utilized in the teaching of undergraduates in education and in the motivation of eighth grade students to improve language skills. There are immediate implications for technology integration in the teacher education curriculum and for the collaboration of preservice teachers with students in middle schools. With the information gained from this study, there are indications that further studies could explore the possibilities of utilizing technologies to widen the experiences of preservice education students. The preservice curriculum for teachers of reading in the secondary schools and middle school language arts curriculum could be modified to include early field experience contact while students are still under the auspices of and directed by the university instructor.

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Table 1. Selected survey item response.

	Pre Survey	Post Survey	
Ability to send e-mail message	x=2.21 sd=1.54	x=4.21 sd=0.83	change +2.00
Ability to respond to writing	x=3.16 sd=1.05	x=3.94 sd=0.51	change +0.78
Reading interest of eighth graders	x=2.89 sd=0.91	x=3.89 sd=0.78	change +1.00
Writing ability of eighth graders	x=2.63 sd=0.87	x=3.78 sd=0.76	change +1.15
Motivating reluctant readers	x=2.63 sd=1.03	x=3.68 sd=0.72	change +1.05

Distance Teaching with Interactive Television: Strategies that Promote Interaction with Remote-site Students

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The rapid growth of technology in America is creating large-scale changes in our society, especially in the types of employment available and the job skills that they require. In an effort to better prepare learners for these societal and work-place changes, educational institutions and providers also adopt emerging technologies in an attempt to make the educational enterprise more efficient and effective.

One of the newer and quite promising educational technologies is interactive television, a learning environment that allows live two-way audio and video communication between teacher and students at multiple sites. Providers have heralded it as a technology which can help overcome the barriers of cost and equity of access for students (Hezel & Dirr, 1990), while offering an interactive environment similar to traditional education (Ehrmann, 1993). Many students and faculty proclaim its value because it eliminates the often-criticized shortcomings of educational television used in the 1950's and 1960's (Chu & Schramm, 1967), permitting easy and immediate exchange of verbal and nonverbal information. In fact, students do rate teachers higher if they maximize student participation (Eble, 1972; McKeachie, 1969; Phoenix, 1987; Weaver, 1978).

The purpose of this study was to examine this interactive capability as it related to teacher effectiveness in using interactive television. The literature review prepared for this study documented the importance of interaction for:

a) many types of learning (Hackman and Walker, 1990; Keller, 1994; Reder, 1982; Webb, 1983)

b) learner satisfaction (particularly in postsecondary students)(Beare, 1989; Chu & Schramm, 1967; Ellis & Mathis, 1985; Jurasek, 1994; McKeachie, 1969; Ritchie & Newby, 1989) and

c) persistence of distance students (Garrison, 1990; Holmberg, 1989; Sweet, 1986).

It also summarized the theoretical discussion on the importance of interaction in distance learning (Garrison & Shale, 1990; Holmberg, 1989; Moore, 1983) and presented relevant research from the communications literature on interaction in traditional classrooms (Andersen, 1986; Norton, 1986; Richmond, Gorham & McCroskey, 1987, etc.). Therefore, recognizing that interaction contributes to student learning, satisfaction, and persistence and that interaction is a complex construct involving instructor, technology, and student variables, it seemed important that we understand what instructional strategies/tactics/behaviors teachers can employ to maximize the interactive capability of interactive television technologies. For a variety of reasons, a naturalistic/qualitative methodology was chosen to explore this question.

Methodology

Setting

A midwestern, community-college district provided the location for this study. Its main campus is located in an agricultural area on the outskirts of a modest-sized city. Its students come from a seven-county region covering 4300 square miles with a population of over 350,000 people. Outlying centers in seven small communities and a men's reformatory are linked to the main campus and each other by an interactive television network which transmits instruction to the multiple remote sites simultaneously. The reformatory is connected via voice transmission only (in keeping with state law); all other sites enjoy two-way audio and video capability.

The origination classroom contains long tables with table-top microphones; a podium that allows maximum control by the instructor of what view appears on the screen; three cameras aimed at the instructor, the students, and the surface of the podium (functioning as a visual presenter); technology equipment installed into the podium for easy access by the instructor (VCR, audio tape player, laserdisc player); a wireless microphone for the instructor to wear; three monitors for students and the instructor to see what is being transmitted over the system; and a bank of course files where students pick up class handouts and returned assignments. The remote sites have one camera aimed at the students, similar tables and microphones, course files, and one or more monitors. These remote classrooms are housed in community college centers where college staff is available for registration, advising, and academic support.

Subjects

The primary subjects for this study were five faculty members who were highly-rated by students in previous distance education classes, who were known to make extensive use of interactive instructional strategies in their interactive television classes, and who had two to nine years of experience teaching on the system. Two were women; three were men. Three were full-time faculty and the other two were part-time. They represented several different dominant teaching styles and five different content areas (human relations, sociology, education, composition, and mass media) (see Appendix A for brief introductions to the five faculty; names have been changed to protect their privacy).

Students in the five classes also participated in the study by completing Student Response Forms. Twenty-nine of the remote-site students also served as members of remote-site focus groups. A focus group is a homogeneous group of participants, that is from the same course, same site, who are interviewed in depth about a given topic (e.g. faculty/student interaction in their course) (Lederman, 1990). (see Appendix B for an overview description of the student sample.)

Data Collection and Review

A naturalistic study was designed to examine the interactive teaching strategies/ tactics/behaviors used by the five experienced faculty members from five different disciplines. The investigator observed them, interviewed them, and studied videotapes of their classes during three periods of the semester (beginning, middle, end). She surveyed their students (at the beginning, middle and end of the semester) and spoke with two focus groups of remote-site students from each class. (see Appendix C for a more detailed description of the primary data collection activities of each phase.)

At the completion of the data collection, the investigator completed detailed narratives of all of the videotapes and tested the validity of her observations against the narratives produced by an outside observer. All of the narratives, interview transcripts, and field notes were examined so that the data could be synthesized. Categories of instructional behaviors were identified from the results and used to color code all of the data sources.

Results

The data analysis led to the labeling and grouping of most of the behaviors into seven broad categories. A cross-instructor comparison along the dimensions showed many commonalties and some distinct differences between the individual instructors. The seven dimensions were:

- nonverbal "immediacy" behaviors
- verbal "immediacy" behaviors
- behaviors that personalize the class
- technology management strategies
- methods for acquiring student feedback
- methods used to manage student participation
- active learning strategies

Although none of the dimensions, except technology management strategies, were unique to distance education, the manner in which they were manifested and their relative level of importance did appear to vary from traditional higher education. Nonverbal and verbal "immediacy" behaviors, efforts to personalize the class for each student, and active learning techniques appeared to collectively establish a climate that supported remote-site student participation. Within this climate, the instructors encouraged verbal and nonverbal interactive behavior, solicited information on immediate student needs, employed questioning/ responding patterns of participation management which fostered continued student involvement, and manipulated the technology in ways that promoted student participation.

For some of the dimensions (nonverbal immediacy, verbal immediacy, personalizing the class, and feedback methods), the instructors exhibited very similar behaviors. For the other dimensions (technology management, management of student participation, and active learning strategies), the faculty members were quite different from one another, reflecting their respective teaching styles.

Nonverbal Immediacy

Immediacy refers to the degree of perceived warmth or closeness between people (Mehrabian, 1972). Much of this perception is created nonverbally as people communicate with one another. Because television is not generally perceived to be a warm medium, the five instructors in this study all found that making an effort to nonverbally communicate approachability and warmth contributed to participation of the remote-site students.

For example, three of the five instructors kept the camera shot in a close enough range that the upper half of their bodies filled nearly fifty percent of the screen. This made it easy for students to see their facial expressions, gestures, and smiles and feel as if the instructor was establishing eye contact (Peter, Rita, LuAnne). The other two instructors set the camera view slightly farther back but not so much that the students couldn't easily see the same behaviors (Mathew, Jack).

Facial expressions were positive and warm (i.e., frequent smiles, animated and expressive facial expressions, raised eyebrows; tilted head with an "I wonder," interested expression when students were speaking; pointing to chin or nodding slightly while intently listening and pondering an idea a student was sharing). Four of the five maintained frequent eye contact with the camera (Rita, LuAnne, Mathew, Peter). They often shifted their eyes back and forth between the students and the camera when they were talking, and usually looked at the camera when a remote-site student spoke. John tended to look at the students in front of him most of the time, but did look at the camera or switched the camera to the distance site when remote students participated.

All five appeared very relaxed, using some gestures when speaking, occasionally leaning back slightly in the chair. Peter used expressive gestures to illustrate points and often leaned toward the camera with "energy" when speaking. He seemed to be most aware of the power of the medium and how he could use facial expressions, gestures, and posture to convey his ideas or emotions to the students "out there." However, because he only had two students enrolled at the origination site, he may have been freer to focus his attention more on the remote-site audience than some of the others.

Verbal Immediacy

Verbal "immediacy" refers to how the instructors use verbalizations to enhance their sense of approachability and warmth to the students. For example, all five of them used humor often to poke fun at themselves or to lighten the mood. They did this by providing humorous, often personal examples to illustrate a concept. In addition to humor, all five faculty offered frequent positive encouragement when students contributed to the class discussion. John tended to do this by expressing interest in the idea, posing questions that asked the student to elaborate more, or using the idea himself to show everyone how it related directly to what was being discussed. He tended to reward them for contributing rather than commenting directly on the quality of each response (e.g. "I'm glad you brought that up." or "I'm looking forward to hearing your ideas next time."). The others used a variety of strategies including elaboration of student ideas, expressions of intense interest in student ideas, attempts to clarify what the students were saying so that they got the impression they were really trying to understand, and words of positive reinforcement whenever students spoke.

A third type of verbal immediacy behavior used by all five faculty was the frequent sharing of personal examples or ones highly relevant to the students. By combining these behaviors with nonverbal immediacy behaviors such as good eye contact, relaxed posture and gestures, and vocal and facial expressiveness, students felt their instructors wanted to hear their questions and ideas. By creating a context in which student participation was expected and desired, and by establishing a set of informal rules for that participation (see participation management section below), students did not need to suspend their social needs while learning course content in a distance learning environment.

Personalizing the Class

Personalizing the class refers to strategies that instructors used to make the learning experience personal, relevant, and sensitive to the needs of individual students. All five instructors made an effort to learn all of the students' names and used them frequently in class. They also learned their voices, so that as the first few weeks went by, it became much less important for the students to say "This is Becky from ________ (remote-site)." Learning names/ voices was accomplished in different ways: by taking roll (all five used this technique), using a site-by-site guide sheet the first few weeks of class (Mathew and Peter), by teaching from the remote-sites occasionally (Rita, LuAnne, Peter), and by soliciting short assignments or planning in-class activities to help get to know the students better.

In addition, all five solicited information by having students fill out a roster card during the first class. Almost all of them requested additional information on the back of the card relative to students interests/goals/experiences that had to do with the specific focus of the course.

Other strategies used by the instructors to personalize the class included the use of get-acquainted activities during the first class or two (Mathew, John, Peter); originating from each of the sites at least once during the semester and allowing for individual student appointments before or after class regarding assignments and/ or career counseling (LuAnne, Rita, Peter, John); and coming early to class/staying after class/ remaining on-line during break to discuss individual questions about paper topics or project direction (Rita, Peter, John).

Finally, all five instructors made it clear that they wanted to be available to students for out-of-class contact. They listed how they could be reached on their syllabi and described the available options during the first class period. They reminded students of these options during subsequent classes, as exams approached, or due dates for student assignments drew closer. All five listed phone-in office hours on their syllabus or encouraged students to call them at home if they were part-time faculty without offices. They mentioned voice mail, the written mailgrams that are available at each site for mail-in questions, and phone availability at the main campus or remote site immediately after class.

Technology Management

The classroom on the main campus, where the classes originated, was designed to give the individual faculty member maximum control over the instructional environment. This means that the instructor could switch the video signal to any of the remote-sites at any time, or switch the camera view in the origination site from him/ herself to the students or to the overhead camera when displaying instructional materials. Several of the faculty mentioned that it took a little practice at first to remember to attend to the technology in addition to the other teaching activities they were accustomed to monitoring. However, all five of them found ways to use the technology to support the kind of student participation they desired.

Collectively, all five used the first few classes to teach their students technology protocol. For example, by taking roll and testing the audio system at the beginning of each class, the students learned that someone at each site needed to press down the microphone button and say something. The instructors asked the students to say, "This is Michelle from _______," whenever they wished to speak. (This rule was relaxed within a few weeks because everyone appeared to have learned names and voices.) They also discussed what to do in case the technology was down for a particular class.

All five tried to remind the origination site students to use their microphones when talking so that the other sites could hear. Finally, all of them put up a camera view of one of the sites or of an interesting visual whenever class was not in session, such as prior to class, break time, or during small-group break-out sessions.

The five instructors used the technology in different ways to support the kind of interaction they were trying to facilitate. These observations suggested that when discussing controversial subjects, leading fast-paced discussions with input from many students, or asking for one or two-word responses, it was more effective to leave the camera view on the instructor to keep from shutting down the conversation or breaking the momentum. When attempting to expand participation, switching to a site to "call" on them could be effective.

Using the technology to monitor group break-out sessions and other in-class activities, or to solicit feedback and site-by-site reactions was also common practice. Switching to a particular site to talk with an individual student about a class topic or a question about a class assignment appeared to send a signal to the student that the instructor was willing to talk at more length about this matter. Finally, by switching frequently between the instructor, the sites, and the overhead camera view, the instructor forced students to focus their attention on different things (group directions, lecture visuals, people at a site, the instructor, etc.). This can be a very effective technique for holding and directing attention, not easy to duplicate in a traditional classroom.

However, when the camera view changed infrequently, student attention at the distance sites was difficult to maintain. Although the researcher observed this happening on occasion in all five classes as she visited the remote sites, it was a consistent problem in the sociology class where the camera view seldom changed. Students often conducted side conversations irrelevant to the class content during lectures. However, when the instructor returned the camera from the overhead view of her outline to herself for class discussion, the students were able to refocus their attention on the class and seemed to be somewhat aware of what the instructor had presented during the lecture. Much like "watching television" at home, they appeared to have been partially listening to the program while "doing" something else.

Feedback Methods

Faculty in traditional classrooms often claim that it is the nonverbal clues they acquire by scanning the student audience that tells them to take a break, tell a joke, or provide another example. They suspect that they can not get that kind of information in a distance "classroom." Actually, the five instructors in this study all found methods to acquire this kind of information in alternative ways.

First, how does one find out if the students are understanding the content? Is their understanding sufficient to move on? In a traditional classroom setting, an instructor might watch for confused or frustrated facial expressions and use those clues to think up another example or rephrase an explanation of the concept. The instructional television (ITV) faculty sample acknowledged the value of reading nonverbal clues too. They said that they rely partially on the nonverbals of the origination site students. The instructors reason that if the origination-site students are confused or tired, probably the remote-site students are too.

However, the origination-site audience provides only part of the feedback needed. John and Peter attempted to collect additional information every ten to fifteen minutes in class by asking such questions as "Anyone have some vocabulary they'd like to ask about?"; "Any further questions about this?";"What questions do you have before we move on?" In short, they all used a combination of nonverbal clues from the student audience in front of them and regularly posed questions (every ten to fifteen minutes for four of the five) directed to the class as a whole that gave the students an opportunity to say, "I'm lost" before getting too much farther on the class agenda.

What other types of feedback do the instructors seek? Often, they send out handouts to be discussed or student papers/projects that have been graded. All of the instructors were attentive in making sure all of the sites had received the designated papers before launching into a discussion about them. Four of the five sought out information on the class process itself. For example, Rita and LuAnne often asked if anyone needed them to slow down or repeat anything, since they lectured without stopping for longer periods of time than the others. Others asked for written formative evaluations (John, Peter); for input on whether students wanted additional explanations for class assignments (LuAnne, Peter, John); or for a preference of format for exams, review sheets or class activities (John, Rita). Four of them used the technology, as well, to switch to each site during group activities to monitor progress and determine if the students understood the task they were to accomplish.

Finally, four of them used the silent switching capability of the system to find out if students were all back from the break, present at the end of the class, or awake during a class discussion when the instructor had not heard from a site for a while. Feedback on how the students were doing at any given time, then, can be acquired by noting the nonverbals of the origination-site students, by regularly asking if the students have questions or have received printed materials, by monitoring written assignments, by soliciting reactions to class process issues, and by using the technology to silently monitor "what is going on at the sites."

Management of Student Participation

Focus group interviews and direct observation of classes revealed the "shoulds and oughts" that were directly or indirectly communicated by each faculty member regarding participation in each class. Each achieved a unique pattern of interaction that relied on nonverbal and verbal immediacy behaviors, personalizing activities, feedback methods, and technology management techniques to establish a climate and a routine that contributed to and supported each faculty member's teaching style. This section describes a few of the commonalties across instructors. A more detailed description of faculty differences appears in the dissertation.

In all cases, the instructors had emphasized their desire for the students to participate actively during the first class. They began by giving the students some practice using the microphones, for example by asking simple questions: "Are you here, Erin?"; "Tell us your favorite music or something else off your ITV Roster Card that you would like to share with us." None of them insisted that the students who were sitting out of camera range move into view, except for a brief introduction during a get-acquainted activity. On the first student survey, several students mentioned that they were camera or microphone shy; a couple mentioned during the focus group meetings that they appreciated the opportunities for small group activities rather than having to speak on the microphone all the time. Four of the five used small group activities often in their daily classes. See the next section for further elaboration.

Active Learning Strategies

All five instructors talked about the need to use a variety of methods in a distance education class, changing the pace regularly and avoiding the "sit and watch" routine that is the norm in home television viewing. John felt that active learning was equally important for traditional students, but the others all felt that it was even more critical for distance students. Active learning strategies are discussed here because all of the instructors mentioned them during the faculty interviews as a tool they used to stimulate verbal interaction, a part of the bigger picture of "climate."

This section will touch on those active learning tactics that have not already been discussed in this report and that were employed by the faculty to contribute to the interactive climate of their classes. Some of the faculty (John, Rita, Peter) claimed that tactics which help keep the students' attention are not only important in a television setting but they are often easier to manipulate in a distance classroom than a traditional one. For example, making sure the visual image on the monitor changes at frequent intervals seems to attract attention to the screen. This is accomplished by showing different still visuals such as graphs or descriptive tables (John, Mathew); switching to different sites (Rita, John, Mathew, Peter); showing video clips (Rita, LuAnne); showing student presentations (John, Peter, Rita); and focusing the camera on the instructor for short periods of time.

Assuming the students' attention is attracted to the changing monitor image, other tactics were used to direct the students' attention to important features of the screen. Rita, John, and Mathew frequently pointed a finger or a pen to points of interest on a visual display or wrote on the visual itself. All of them used the overhead camera to put up a copy of a handout, exam, or other material that had been sent to all of the sites to help everyone locate the item before it was discussed.

Focusing attention is a very small part of keeping students "ready" to participate, however. The kind of active learning most of the faculty were referring to in their interviews involved participation in an activity other than watching the monitor. These instructional tactics promoted physical involvement as well as mental or verbal participation. For example, John, Rita, Peter, and Mathew frequently used small-group break-out sessions to discuss a question or solve a problem relevant to the day's topic. They also assigned student presentations on articles, projects, or papers.

Other structured activities that some faculty used to get everyone involved included dyad or triad quick discussions (John, Peter); structured sharing where everyone told the class a prescribed bit of information such as a 1950's TV show (Rita, John, Mathew); microteaching lessons presented to the students at their own site (John); self-tests, review sheets, or surveys completed during class and then discussed (John, Mathew); journal entries such as reactions to class experience or prescribed topics from the instructor (Mathew, Peter, Rita); and readings that were used as a stimulus for later discussion such as case studies or handout sections (John, Mathew, Peter, Rita, LuAnne).

Student Responses

Student responses to the particular strategies/tactics/behaviors used by each instructor were determined by administering three surveys and conducting two focus group sessions with remote-site students from each class. Overall, 86.5% of the remote-site student respondents (n=95) expressed a preference for a teaching style that involved significant teacher/ student or student/ student interaction (Student Response Survey Two, Q7). However, 55.4% (n=74) did not feel comfortable participating in class unless the climate was supportive of student ideas (SRS Three, Q7). The percent of the respondents (n=94) who found it easier to participate in their ITV class than they had expected was 63.2% (SRS Two, Q14); many (69%) (n=95) found that they were at least as comfortable participating as they were in traditional classes (SRS Two, Q10).

Specifically, the remote-site students appreciated instructor eye contact with the camera, reminders to the origination-site students to use their microphones, supportive written feedback on written assignments, occasional visits by the instructor to their site, effective use of the overhead camera, efforts by the instructor to determine if the students understood the day's content, frequent changes of pace or activities, and a friendly ambiance. They also liked opportunities to do small-group activities at their sites, especially early in the term, so they could get to know their fellow classmates better (Focus Group Interviews #1 and #2).

Other Variables

Although the major instructional influences in interactive television centered around the seven dimensions discussed above, three additional important variables merit mentioning. First, the basic teaching philosophy of the instructors seemed to motivate each of them to search for ways to encourage remote-site student participation. All of them genuinely believed that verbal participation was a valuable activity that contributed to learning of their class content.

Secondly, the camaraderie of each remote-site group appeared to contribute to whether the students were able to interact with and support each other during class and outside of class. The researcher observed that the faculty, through the use of group break-out sessions and efforts to link up sites with only one or two students, seemed to strengthen the site's ability to remain focused on the day's topic and enjoy the opportunity to participate in class discussion.

Finally, it appeared that the willingness of the faculty member to be contacted outside of class gave the students the impression that he/ she valued contact with students and welcomed questions. Although many students did not feel a need to contact the instructor, several of them mentioned during the focus group interviews that the fact that the instructor welcomed this kind of contact made them feel more comfortable about speaking up in class.

These three peripheral variables are not faculty-controlled, in-class instructional behaviors, but they each are faculty-controlled, outside-of-class variables which appear to influence in-class interaction. They need to be explored more thoroughly in subsequent research.

Interactive Distance Teaching vs. Traditional Instruction

A secondary data analysis was completed when the descriptive data was compared to the published literature on effective traditional instruction to determine if the results were unique to instructional television. Although none of the dimensions, except technology management strategies, were unique to distance education, the manner in which they were manifested and their relative level of importance did appear to vary from traditional higher education. For example, immediacy and personalizing behaviors as well as methods used to manage student participation are important aspects of establishing a supportive interactive climate in any class. However, in the interactive television context the instructor must make a special effort to reach students who are not present in the room. It would be easy to employ an "out-of-site-out-of-mind" manner of relating to these remote site students. Eye contact, in particular, must be simulated, i.e. the instructor looks at the camera so that students feel like he/she is looking at them. Remote-site participation must be monitored and encouraged so that class discussion is not confined to only those at the origination site.

Similarly, instructors often seek feedback about student understanding of the content in all of their classes. Distance instructors, however, must use a different set of information sources to secure this feedback since they cannot rely on sensitive perception of nonverbal clues in the audience as easily. Remote-site students are out-of-site much of the time, and the camera view at the sites is often so distant that subtle nonverbal student behaviors are difficult to pick up when viewing the screen. For a more complete discussion of the unique aspects of these variables, as they relate to interactive television instruction, see the original dissertation document.

Conclusion

The results of this study have enormous implications for faculty training and support, for evaluation, and for potential follow-up research, the instructional strategies of the faculty in this study (Baker, 1994).

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Appendix A
Faculty Descriptions
(names changed)

Mathew

Mathew is a 33-year-old full-time faculty member in the marketing department. He teaches traditional classes on the main campus, and has taught human relations for nine years on the interactive television system. He has extensive retailing experience and has sold real estate. There were 25 students in his class (evenly divided between males and females), with 64 percent of them enrolled at the remote sites. Human relations met three times per week for one hour and ten minutes each.

John

John is also a full-time faculty member and is 44 years old. John has taught at the community college for 17 years, six of them on the interactive television system as part of his teaching load. He is a member of the education department and teaches educational psychology and other courses aimed at students seeking teacher certification. He taught introduction to teaching on the interactive television system this term. There were forty students in the class (nearly twice as many females as males), 62.5 percent of them enrolled at remote sites. introduction to teaching met twice a week: Tuesday for one hour and ten minutes and Thursday for two hours and ten minutes.

Rita

Rita is a 44-year-old, full-time faculty member and chair of the Journalism and Public Relations department. She teaches traditional classes on campus, and has taught mass media for four semesters on the interactive television system as well. She has worked as a city editor and reporter, and has logged 18 years of teaching. She still does some "moonlighting" reporting "to keep herself in touch with the field." There were 26 students in the class (evenly distributed between males and females), and 54 percent of them were enrolled at remote sites. Mass media met once a week for two hours and 45 minutes.

LuAnne

LuAnne is a 42-year-old, part-time faculty member. She has taught traditional classes in anthropology on campus for three years, and has taught introduction to sociology for two years on the interactive television system as well. She has taught at the high school level and is presently working on her Ph.D. in Anthropology at the state university, doing research on drug and alcohol abuse among Maltese immigrants. There were 29 students in her class (more than twice as many females as males), 79 percent of them enrolled at remote sites. Introduction to sociology met twice a week for one and one-half hours each.

Peter

Peter is a 39-year-old, part-time faculty member. He has taught traditional classes in composition on campus for three years, and has taught composition I for two years on the interactive television system as well. His academic and professional background has involved acting and film, as well as teaching study skills, reading, and composition at three four-year colleges as well as the community college. There were 21 students in his class (1:3 males to females), 91 percent of them enrolled at remote sites. Composition I met three times a week for one hour and ten minutes each time.

Table 1

Summary of Faculty Descriptive Data

	Mathew	John	Rita	LuAnne	Peter	Mean
Age	33	44	44	42	39	40.4
Discipline	HR	TH	MM	SC	CPI	
ITV yrs.[a]	9	6	3	2	2	4.4
Dominant style[b]	L/D	L/D	L + L/D	L + L/D	L/D + D	
Class size[c]	34	47	39	35	28	36.6

Note. HR=human relations; TH=introduction to teaching; MM=mass media;
SC=introduction to sociology;
CPI=composition I

[a] Number of years the faculty member has taught on the microwave system.

[b] Dominant teaching style as described by students: L/D refers to lecture/ discussion format; L to lecture primarily; D to discussion primarily.

[c] Enrollment figures based on 10/1/93 registration figures

Appendix B

Table 2
Summary of Remote Site Student Descriptors

	HR	TH	MM	SC	CPI	Mean/ Total
# at remote sites [a]	21	30	23	28	25	25.4
# remote SRS Two[b]	16	25	14	23	19	97
M/ F proportion	50/50	44/56	50/50	30/70	21/79	39/61
Age: 18-20	8	17	5	5	6	42.7%
21-24	2	6	6	5	4	24%
25+	6	3	3	11	9	33.3%
New to ITV	75%	72%	71%	61%	68%	69.4%
New to college	44%	12%	14%	39%	37%	29.2%

[a] Enrollment figures based on 10/1/93 registration figures.

[b] Number of Student Response Surveys filled out during Phase II. All other rows are drawn from SRS Two.

Appendix C
Data Collection

Phase I

Phase I of this study was primarily designed to a) collect descriptive information about the setting so that readers and the outside observer would have an accurate view of the physical environment of the interactive television classroom; b) begin to establish a relationship with the five faculty by getting to know their background and philosophy of teaching; c) identify and explore factors that faculty think about when planning a course that they anticipate teaching on interactive television; d) record student orientation activities and other faculty behaviors during the first two days of class that might contribute to student attitudes and interactive behavior; and e) solicit first impressions of the social climate as the students perceive it after one day of class.

Phase II

Phase II was designed to: a) collect descriptive information about some of the remote-site settings so that readers and the outside observer would have an accurate view of the physical environment of these classrooms; b) record instructional techniques and faculty behaviors that occurred during class-time interaction (from the remote-site); c) record student behaviors at the remote sites during class (when the microphone was on and off); and d) solicit student attitudes and observations about the interactive climate in the class.

Phase III

Phase III focused on specific instructional techniques used by the faculty to promote interaction, from the faculty's, students', investigator's and outside observers' perspectives. The faculty interview strategy, student survey questions, and focus group discussions were designed to test emerging ideas from the data analysis of Phase II, as well as to identify any new information that might emerge because it involved a later period in the semester.

Assessment of Distance Education Implementation in Iowa: Concerns and Indicators of Success

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Rationale and Related Literature

Distance education--instruction occurring with teacher and learners proximally separated--isn't a particularly new phenomenon, but recent advances in telecommunications technologies have focused attention on its potential applications for classroom instruction. As a discipline, distance education is young enough that much of the scholarly literature published well into the 1980s were attempts to define what it is and is not (see, for example, Garrison & Shale, 1987; Keegan, 1990; Rumble, 1989). As a result, in-depth knowledge of distance education within the education community is limited.

Despite this lack of understanding, distance education utilizing telecommunications technologies has spread rapidly throughout the United States. In 1987, one in five states reported "involvement" of K-12 schools in distance education activities. One year later, two-thirds of the states had institutions that had invested in instructional telecommunications, and by 1989, virtually every state had at least one school district that had implemented or planned to implement a distance education program (Office of Technology Assessment, 1989).

Unfortunately, this proliferation of instructional telecommunications programs has not spurred the development of concurrent programs to train teachers for these new technologies. Many teachers facing a television-teaching assignment "are left to grapple with the new program on a 'sink or swim' basis" (Batey & Cowell, 1986) finding their way through trial-and-error or by falling back on techniques and strategies successful in conventional classrooms, but which may prove inappropriate for this new environment.

Distance education instruction *is* different. Teachers involved in Minnesota's Interactive Television project reported that they had to change their teaching methods (Office of Technology Assessment, 1989) and experienced telesystem teachers consistently report that preparation is different and takes longer than for conventional classroom instruction (Dillon & Price, 1990; Massoumian, 1989; Burnham, 1988). The questions remain: How can we most effectively address the issue of faculty readiness for distance teaching opportunities? How do we identify and analyze the factors that will enable instructional designers to create successful faculty development interventions?

The Concerns-Based Adoption Model (CBAM) is used to categorize and describe the concerns that professionals have about an innovation, such as distance education (Hall & Hord, 1987). The first dimension of this model deals specifically with Stages of Concern (SoC). The SoC instrument is used to assess where, along a continuum of seven sequential stages, individuals faced with an innovation are. This continuum begins with simple awareness and progresses to the development of ideas for tailoring the innovation to their specific needs. The stages (in order) are: Awareness, Informational, Personal, Management, Consequences, Collaboration, and Refocusing. Ideally, the individual progresses through the stages without becoming fixated or "stalled" at any point, although determining if this has happened (by using the SoC instrument) can provide useful information for those charged with implementation of the innovation.

Understanding and valuing the role of attitudes in the change process cannot be underestimated. Anyone who has attempted to break a self-destructive habit (smoking, for example) realizes that just *knowing* that the habit is harmful is not enough to discontinue it. There is an affective dimension that directly influences behavior change--whether adopting a new behavior or abandoning a current one--in individuals. Nasca (1980) described the change process as developing from "relationships among knowledge, attitudes, and behavior." Therefore, looking only at the "hard data" of hours spent teaching on the Iowa Communications Network (ICN) or number of teachers "in-serviced" may not supply a comprehensive picture of the situation. While following up on a school's implementation of a major educational restructuring, Robbins (1986) discovered that there were elements of the change that had not been documented initially, but that significantly influenced the outcomes of the project. After the early excitement of the innovation wore off, a noticeable decline in active participation occurred. Only through gathering and studying previously uncollected data related to attitudes, teacher perceptions, and lack of long-term, ongoing support did a clear picture of the problems appear.

The tendency of individuals to continue using an innovation, once adopted, also relies on the effectiveness of the change agent in supporting the implementation process (Rogers, 1983). Faculty who participate in inservice activities designed to introduce an innovation cannot be abandoned once they've been exposed to these new ideas. Research on innovation adoption suggests that "reinforcing messages" of various kinds may encourage continuance in the process of adopting a new idea, product, or strategy.

Individuals expected to participate actively in the implementation of distance education must also be given *time* to develop appropriate skills and experiences. In describing the efforts of school administrators in encouraging professional development among faculty, Daft and Selwyn (1978) remarked, "The decision to increase the professional level of teachers requires a long-term commitment" (p. 191).

As any instructional designer knows, a solid understanding of the context in which s/he intends to work facilitates effective decision-making. By using the CBAM to create a knowledge base about faculty needs, the designer has an organized source of problem-solving data close at hand. Appropriate interventions (such as inservice workshops or print materials) can then be prescribed to address the teachers' concerns and encourage movement toward a higher stage of concern. This study was initiated to facilitate this information-gathering process, analyze the data, and provide a "snapshot" portrait of teacher concerns regarding the implementation of distance education technologies in Iowa.

The research questions, consequently, that guided this investigation were:

> 1) What are the concerns of Iowa teachers regarding the implementation of distance education technologies and their participation in this implementation process?
>
> 2) What degree of involvement with distance education characterizes the "average" teacher who has participated in a Teacher Education Alliance- (TEA) sponsored workshop?
>
> 3) Are there correlations that exist among sub-groups related to number of years teaching, gender, grade level, or participation in professional associations?

The overall goals for this project also included the development of recommendations for inservice activities based on the results of the study. In this way, the hierarchical, ongoing nature of successful inservice is facilitated, as opposed to a "one-shot" solution that ignores the long-term support functions implicit in the adoption and diffusion of this large-scale innovation.

Methodology

Subjects

Seventy-five mathematics teachers participated in an ICN teacher training workshop and/or institute during the 1992-93 academic year. Each of these individuals was sent a descriptive survey and forty-four of these questionnaires were returned, providing a fifty-nine percent return rate.

Of these subjects, 26 (59%) were female and 18 (41%) were male. Seven of the respondents (17%) were relatively new to the field, having been a teacher for five years or less. Those with six to twenty years of teaching experience accounted for 13 of the responses (30%), and the majority of the subjects (53%) had been teaching for more than twenty years.

A majority of the teachers, 32 (72.7%) taught grades 9-12. Of the other 13 teachers, 6 taught grades K-4, 3 taught grades 5-8, and 3 taught a mixture of grades 5-12. One teacher omitted the information. Predictably, a majority of the secondary level teachers indicated that they have either a mathematics degree (87.1%) and/or a mathematics education degree (80.6%) at either the undergraduate or graduate level.

Instrumentation

The survey instrument that was distributed consisted of three parts, each of which provided specific information regarding the participants' level of professional activity either with the ICN or with mathematics education reform issues. The first part of the survey instrument was written by Fagan (1991) to assess the level of participation in the Iowa Council of Teachers of Mathematics (ICTM), the National Council of Teachers of Mathematics (NCTM) or other professional mathematics organizations. Participants were asked to indicate in which organization or combination of organizations they actively participated either through membership, journal reading, conference attendance, publication of articles, and/or conference presentation activity.

The second part of the survey instrument was the Stages of Concern About the Innovation (SoC) Questionnaire developed by Hall, Wallace, and Dossett (1973) as the first dimension of the Concerns-Based Adoption Model (CBAM). The purpose of CBAM is to diagnose and identify an individual's stage(s) of concerns and then prescribe appropriate interventions (inservice workshops) for the resolution and the movement toward higher levels of concern (i.e., impact related concerns) (Hall & George, 1979).

The SoC questionnaire consists of 35 items from which a respondent's stage(s) of concern can be determined. The reliability of the SoC Questionnaire was determined by a one-week test-retest study conducted during the two and one-half years of research related to SoC (Hall, George, & Rutherford, 1979). The stage score correlations ranged from 0.65 to 0.86; four of the seven correlations were above 0.80 (Hall et al., 1979). For the same study, estimates of internal reliability ranged from 0.64 to 0.83 (Hall et al., 1979). A series of validity studies resulting from its use in longitudinal studies "provided increased confidence that the SoC Questionnaire measures the hypothesized Stages of Concern" (Hall et al., 1979, p. 20).

The third part of the questionnaire was a 59-item Mathematics Teacher Questionnaire developed by the National Council of Teachers of Mathematics (NCTM) to assess the level of implementation of the *Curriculum and Evaluation Standards for School Mathematics* (1989) and the *Professional Standards for Teaching Mathematics* (1991). The 1992 pilot study involving mathematics teachers in grades K-12 in 11 states from 121 schools surveyed their attitudes toward teaching, their instructional practices, and their knowledge of the *Standards* (NCTM, 1992).

Data Analysis

For each respondent, the data from the Stages of Concern Questionnaire (SoCQ) was transformed into a SoC profile using the Quick Scoring Device for the Stages of Concern Questionnaire developed by Parker and Griffin (1979). The analysis of the profiles was performed using the complete profile interpretation as described in Parker and Griffin. Due to the subjective nature of the interpretations, the investigators conferred on the analysis.

The seven SoC profiles were collapsed into five categories of concerns (Unrelated, Personal Positive, Personal Negative, Task, and Impact) as suggested by Hall, George, and Rutherford (1979). The Unrelated concerns (Stage 0) category describes those participants who at the time of the survey were not overly concerned with the use of the ICN. The two Personal Concerns categories (Stages 1 and 2) contain those teachers whose concern centered most on acquiring information and/or on personal concerns relating to their ability to perform within the required needs of the ICN. Teachers identified as having Personal Positive concerns generally have a positive attitude toward the use of the ICN; teachers in the Personal Negative category are more likely to be resistant and negative. The Task-Related concerns category (Stage 3) describes those teachers who are most concerned with management, time, and logistical aspects of the use of the ICN; the teachers identified as having Impact-Related concerns are interested in how the use of the ICN will affect students (Stage 4), in working with other teachers (Stage 5), and/or in seeing other ideas put into practice or at least tried out (Stage 6).

The SoC categories and data from the Mathematics Education Activity Questions and the Mathematics Teacher Questionnaire were analyzed by frequencies. Crosstabulations were used to determine the relationships between the SoC profiles and the other variables.

Results

Subjects

Of the 44 mathematics teachers who responded to the survey, 19 (43%) participated in the ICN institute; 25 (57%) of the teachers participated in both the ICN institute and the workshop. Participation in mathematics education organizations varied from passive (membership, reading professional journals, and attending conferences) to active (making conference presentations and publishing articles). Approximately 60% (26) of the teachers were passively active; 28% had made conference presentations in addition to one or more of the passive activities.

Stages of Concern

Of the five stages of concern, half of the profiles (22) were analyzed as Personal Negative; the next most frequent stage of concern was Tasks (12, 27.3 percent).

Crosstabulation of SoC by various variables, a description of the 22 teachers who were analyzed as having Personal Negative concerns includes:

- teaching at the K-4 grade level may be a factor: 66.6% (four of six) of the K-4 teachers, 50% (16 of 32) of the 9-12 teachers
- gender may be a factor: 11 of 18 (61.1 percent) men, 11 of 26 (42.3%) women.
- level of participation in mathematics education organizations does not seem to be a factor: 13 of 26 (50%) teachers are passively involved, 9 of 17 (52.9%) are actively involved
- participation in the Institute/Workshop versus the Institute only may be a factor: 16 of 25 (64 percent) Institute/Workshop, six of 19 (31.6 percent) Institute only
- years of teaching does not seem to be a factor: 11 of 22 (50%) teachers who have taught more than 20 years, three of seven (42.9%) who have taught 3-5 years or who have taught 6-10 years, two of five (40%) who have taught 16-20 years.
- not having mathematics or mathematics education degree may have a slight effect: 14 of 33 (42.4%) who have math, 14 of 31 (45.2%) who have math education, six of nine (66.6%) who do not have math, 6 of 11 (54.5%) who do not have a math education degree.

Likewise, the teachers who were placed in the Tasks concerns categories have some common characteristics:

- level of participation does not seem to be a factor: 8 of 26 (30.8 percent) were passively involved and 6 of 17 (35.3 percent) were actively involved.
- participation in the Institute only may be a factor: seven of 19 (36.8%) Institute only, five of 25 (20%) Institute/Workshop. Of interest, slightly more (one, to be exact) teachers who received Institute training only have Tasks concerns than have Personal Negative concerns.
- gender may be a factor: 6 of 18 (16.7%) males, 9 of 26 females (34.6%)
- teaching more than 20 years may be a slight factor: 7 of 22 (31.8%) versus two of seven (28.6%) for two other groupings of years
- having a degree in math or math education is a factor: 11 of 33 (33.3%) and 11 of 31 (35.5%) respectively versus one of nine (11.1 percent) and 1 of 11 (9%) of the teachers who do have either degree at any level
- grade level may be a slight factor: 9 of 32 (28.1%) teach grades 9-12, one of six (16.7%) teach K-4, one of three (33.3%) teach 5-8 or 5-12

Stages of Concern	Number	Percent
Unrelated	1	2.3%
Personal Positive	7	15.9%
Personal Negative	22	50.0%
Tasks	12	27.3%
Impact	2	4.5%
Total	44	100.0%

Conclusions

The purpose of this study was to identify teachers' stages of concern regarding fiber optic usage. Furthermore, a description of the teachers identified at each stage was attempted in order to suggest appropriate interventions (i.e., inservices and/or workshops) that would facilitate continual implementation of the ICN and prevent stymied growth toward the usage of the network. Identifying the concerns that teachers have regarding the implementation of the ICN, then using that information when selecting interventions to address the specific concerns, will assist the teachers in resolving early concerns, in arousing more advanced concerns, and, consequently, to become successful users of the ICN (Hall & Hord, 1987).

Based on previous research, the variables of gender, years of teaching, grade level taught, level of participation in mathematics education organizations, participation in the ICN workshop and/or institute, and undergraduate/graduate major/minor in mathematics/mathematics education were considered potential contributing factors to teachers' stages of concern regarding fiber optic network usage (George & Rutherford, 1980; Tye, 1981; Punch & McAtee, 1979).

Unrelated Concerns

The interventions targeted at teachers in one category of concerns need to be different from those for teachers in the other categories. The focus of the interventions for teachers in the Unrelated Concerns category needs to be on providing general, overview information in small amounts that is not too detailed (Hall & Hord, 1987). Hall and Hord also suggest the use of a variety of media such as personal conversations, brief reports in staff meetings, the use of a newsletter, and press releases.

Hall, George, and Rutherford (1979) identified teachers with Unrelated concerns profiles (highest peak at Stage 1: Awareness with relatively low scores on all other stages) as experienced users of the innovation. The description of the respondents in this study who were placed in the Unrelated concerns category does not identify them as experienced users of the ICN. Contrarily, in our opinion, these respondents are aware of the ICN through their participation in the workshop and/or institute but are non-users of the system.

Personal Positive

The description of the respondents placed in the Personal Positive category concurs with the description given by Hall, George, and Rutherford (1979) of teachers with the highest peak at Stage 2: Information. The respondents are aware of the ICN but are minimally involved with activities relating to the ICN. According to Hall, George, and Rutherford, these respondents would be open and responsive to gaining more information about the structure and function of the ICN. Support and encouragement, as well as additional information, are requirements for ensuring the continued involvement of these respondents in the implementation process.

Teachers involved in an implementation process who have intense Personal Positive concerns from a positive, proactive perspective are identified as having slightly higher Stage 2: Information concerns than Stage 3: Personal concerns. Interventions, in addition to disseminating information about the innovation, need to provide reassurance of the teachers' capability to function with the innovation and evidence that the innovation is enthusiastically received and supported by school district administrators and/or the mathematics consultant (Hall & Hord, 1987). Inservices and workshops need to model the use of simple, easily accomplished activities for the classroom and to encourage the development of activities and curriculum materials that reflect the goals of the ICN.

Personal Negative

Fifty percent of the teachers were identified as having Personal Negative concerns. Teachers who have concerns similar to the respondents are described by Hall, George, and Rutherford (1979) as being more concerned about personal position and well-being than in learning about the substantive nature of the ICN. Their concerns are more personal than informational and, hence, the teachers are likely to be negative toward and resistant to any perceived external pressure to adopt the ICN. Hall, George, and Rutherford note that "even when general, non-threatening attempts are made to discuss the [ICN], the high [personal] concerns are intensified and the [informational concerns] are reduced" (1979, p.36).

Intervention facilitators need to be supersensitive to the intense personal concerns and provide for more individual attention (Hall & Hord, 1987). If the personal concerns are not identified and addressed early, the implementation process can be prolonged and, possibly halted (Hall & Hord, 1987). Identification of and inservice activities for teachers with intense personal concerns is imperative to successful implementation of the ICN.

Although disseminating information is necessary, we suggest accomplishing this by encouraging conversations between positive, enthusiastic users of the ICN and the less informed, more resistant and negative teachers. Additionally, opportunities for the more resistant and negative teachers to observe and work with positive, enthusiastic users of the ICN can assist dissemination of information and resolution of intense personal concerns. An individual approach to inservicing will also aid resolution of intense personal concerns by permitting the facilitator to ascertain more easily the specific personal concerns of the teacher and, thus, individualize the necessary interventions.

Tasks

The teachers who have been identified as possessing task-related concerns generally have resolved their lower-stage concerns and are focusing more on time, management, and logistics concerns (Hall, George, & Rutherford, 1979). Although not experienced users, these respondents were moderately well-informed about the goals, objectives, and underlying philosophy of the ICN and appear to be focused on new concerns related to management issues.

The specific concerns of teachers regarding the logistics and management of implementation are constantly changing and remain highly individual. Attempts to use group-based, day-long workshops to inservice teachers with intense management concerns is, therefore, problematic (Hall & Hord, 1987). Instead, Hall and Hord suggest the use of "how-to-do" workshops that focus on specific procedures, a telephone "hot-line" that teachers can call with their dilemmas, a newsletter, or a teachers' manual that can quickly and easily address immediate questions.

The researcher suggests the identification of teachers who have intense task-related concerns and the encouragement of communication among the teachers for support and assistance in answering specific questions related to implementing the ICN. Utilizing a telephone "hot-line" can be expanded to a computer electronic mail system that teachers could access from their classrooms. The ICN consultant/coordinator needs to be available to assist the teachers with individual questions and to give support for the effort.

Impact

The teachers who are the most involved with the ICN are identified as having impact-related concerns. Their concerns relate to the adoption of the ICN and the consequence on student achievement, the effect on collegial relationships with other teachers, and the efforts to redesign curriculum: concerns which describe optimal attributes of mature, experienced, and professional teachers. However, for implementation to be an ultimate success, impact concerns must be resolved (Hall & Hord, 1987).

Teachers with intense impact-related concerns are focusing on the consequence of the innovation on the students, collaboration with colleagues, and making improvements to the innovation. Whereas the focus of the interventions for the earlier concerns is on ways to make the use easier and more comfortable for the teachers, the focus of interventions for impact-related concerns is on increasing the effectiveness for the use of the innovation (Hall & Hord, 1987). Although consequence and refocusing concerns emerge naturally, Hall and Hord state that teachers generally need encouragement and support to collaborate with other colleagues. This can be accomplished by providing time and financial support for teachers to collaborate on writing instructional materials for the classroom that reflect the goals of the ICN.

Summary

Mathematics teachers in Iowa who have participated in either the ICN workshop and/or institute have concerns regarding the implementation of the ICN. The concerns range from those unrelated to the ICN to those related to the impact implementation of the ICN will make.

The concerns may be affected by the variables of gender, years of teaching, undergraduate/graduate degree, grade level, level of participation in mathematics education organizations, and participation in the workshop and/or ICN institute. Of particular interest is the overwhelming number of teachers in the Personal Negative category who attended the workshop and institute compared to the number who only attended the institute. The content and format of the workshop was directed less toward using the ICN to teach mathematics and more to the overall implementation of mathematics curriculum reform. The lack of ICN-equipped facilities which with the participants could practice was problematic. As a result, the participants may have left with more questions pertaining to the use of the ICN than the teachers who did not attend the workshop.

Identification of the concerns of teachers involved in the implementation of the ICN is prerequisite to prescribing appropriate inservices and/or workshops that will best address the needs of the teachers. By viewing this issue from the perspective of change and innovation adoption, those individuals charged with implementing usage of the ICN will be armed with the tactics to make this happen. Further research and exploration emphasizing teacher characteristics, degrees of innovativeness, and levels of use will all enrich the ICN knowledge base, as well as expand the growing pool of research on distance education in the United States.

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Using Diaries to Assess the Learning Needs and Course Performance of Students Served by Three Instructional Delivery Means

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Introduction

Distance education offers tremendous opportunities, as well as challenges, to today's educators. The demand for flexible, relevant educational programs is high. The technological alternatives and capabilities for linking teachers and learners are increasing. At the same time, tight financial conditions confront many higher education institutions. In response to these opportunities and challenges, distance education is advancing, taking on added importance for many institutions, and influencing traditional education in a "convergence" of educational practices (Smith & Kelly, 1987).

Educators often rely on an intuitive sense of potential instructional effectiveness and fail to ask basic questions of students to confirm or reject these intuitive assumptions. Subsequent efforts to reinforce intuition with hard data often fall short. While intuition can provide a glimpse at the potential benefits of distance education, focused research will determine if the current interest in distance education is justified (Willis, 1993).

The effectiveness of educational endeavors is typically measured by learning. However, in the case of distance education, effectiveness encompasses a broader concept. In addition to learning, it may include access to education and availability of educational information and resources, as well as other variables unique to the individual learner.

If quality distance education programming is to be developed and delivered, research is needed to understand the special needs of the off-campus learner. This will, in turn impact the development and delivery of future distance education programming. The results of this research will also enhance the adoption of electronic technologies through more effective and more clearly targeted in-service activities during the course development process. Furthermore, this knowledge will impact the administration of distance education program as well as enhance the distance education teaching and learning process for all students.

Purpose and Objectives

The purpose of this research was to describe students in an Iowa State University College of Agriculture course in regards to the student's attitudes, perceptions, and final course performance when compared to their chosen instructional delivery system—face-to-face instruction, Iowa Communications Network (ICN—a two-way, fully interactive audio and video system), or videotape. Specific objectives that guided this study were:

1. Identify and describe the special needs of distance education learners who self selected the type of instructional delivery system within a College of Agriculture course.
2. Compare the students' performance to the type of instructional delivery system chosen.
3. Compare the students' performance to the special needs and demographic measures identified in Objective 1.

Procedures

Recent years have witnessed a significantly increased interest in applying qualitative research methods to the study of social and cultural processes. The turn to qualitative approaches has been especially prominent in mass communication research. (Jensen, 1991). A key feature of any qualitative method is that students' responses are not pre-coded from the teachers' or researchers' perspective and that the analysis is not derived from pre-specified hypotheses - the analysis is essentially inductive, uncovering 'significant phenomena' or 'essence in a student's experience (Parer, 1988).

Diary studies have been found to be immensely useful for pedagogical purposes, for course evaluation and for basic research. (Howell-Richardson & Parkinson, 1992). In the teaching of language, the use of diaries as a research or evaluation instrument is quite widespread, especially in the area of learner autonomy. The available literature on the use of diaries tends to adopt a very positive tone, but as Howell-Richardson and Parkinson state: "this may be a distortion due to the well-known fact that only 'successful experiments' tend to reach publication and that their 'successful' aspects tend to be emphasized" (p. 74). Howell-Richardson and Parkinson continued by illustrating how their personal contacts suggest that many diary projects are aborted or found to be unsatisfactory in various ways. Based on the Howell-Richardson & Parkinson article and the aforementioned diary references, the researchers believed that diaries were a potential data collection instrument that would allow the study's objectives to be achieved.

Students enrolled in an Iowa State University College of Agriculture course (Animal Science 511—*Applied Ruminant Nutrition)* that was delivered by more than one instructional delivery system [i.e., face-to-face instruction, videotape, and Iowa Communications Network (ICN)] during the Spring 1994 were asked to participate in this study. This course was team-taught by two Animal Science faculty members who received prior instruction on how to use the technology and how to revise their visuals for broadcast presentation (i.e. larger font sizes, use of color, pacing of content).

As a point of clarification to the reader, the ICN is an end-to-end fiber optic digital transmission technology that provides for full color, full motion, interactive video transmission, error-free data transport, and sharp, crisp voice communications. The network links Iowa's schools, public universities, community colleges, independent colleges, government offices and libraries. These facilities are available to Iowans through access points in each of the state's 99 counties thus making everyone within 20 minutes of an ICN user site.

During the first class session, the purpose of the study was explained and students were asked by the researchers to complete three "mini" diaries for seven to ten day periods at the start, mid-term and end of the course. Participation in the study was voluntary as students were assured that the course instructors would not see the individual diaries thus having no potential impact on their course grade. Demographic data was collected from the non-participants and compared to the diary participants as an attempt to increase the generalizability of the data to the entire course population.

Analysis of Data

Diaries were analyzed for common variables and the frequency for which they occur by selected faculty and staff in the Department of Agricultural Education and Studies. This analysis included a 4-step process:

- reading each diary to gain familiarity with the content;
- simplifying what each student recorded, or getting at the "essence"; shortening the diary, but without losing the meaning;
- comparing and contrasting what each student recorded—identifying variations and common themes in the diaries;
- describing the variations between students, and relating the experiences to other concepts and theories of how students learn (Morgan, 1991; Parer, 1988), and using quotations from the diaries to illustrate and highlight students' experiences.

With the qualitative analysis of the diaries completed, five concepts were identified that were either intrinsic pr extrinsic to the learner. In relating these concepts with previous diary studies by Parer (1988) and a summary of research into student learning in distance education by Morgan (1991); agreement was found among the concepts identified in this study and previously published works. With this level of agreement on all five concepts, the researchers chose to utilize the concept terminology provided in these previous works to complete the data analysis and to enhance future discussion of the findings of this study. The final concepts identified through the qualitative analysis were recorded as to their frequency cited within the individual's diary. Additional data analysis also included the relationship of these diary concepts to student course performance, type of delivery system selected, and the other selected demographic measures.

To aid in the reader's understanding of the results, a brief summary of the concepts, as described in the Morgan paper (1991) is provided.

Concept 1: *Course design and assessment* is one of the key areas where distance educators and educational technologist have some scope for influencing how students go about their studies. Parer (1988) described four sub-areas within this concept:

Difficulty in Studying

- 'Getting going' for new students
- Lack of understanding of assignment requirements

Relationship of Assignments to Studying

- Assignment conscious (assignment influences what is studied)
- Assignment blind

Dialogue and Feedback

- Isolation (often emotional and confidence issues)
- Turnaround time
- Need for interaction (meet and discuss assignment with other students or instructor)

Unaware of Course Demands (prior to enrollment)

Concept 2: *Orientation to learning* is the collection of attitudes, aims and purposes that express a student's relationship with a course and the particular educational institution. Unlike motivation, which would describe students as more or less motivated, orientation is concerned with the qualitatively different ways students relate to their courses. The main variations in orientation are set out in Figure 1. These orientations have been identified with both on-campus students and those studying at a distance (Gibbs, Morgan, & Taylor, 1984).

An important feature of orientation is that it is not fixed. Students will change and develop over time. The notion of changing orientations is particularly important with adult students, who often comprise the largest population of students studying at a distance. With adult students, often studying part-time, the interactions of career 'lines' (in the workplace or domestic setting) with career 'lines' as a student contribute to the changing contexts of orientations.

Figure 1

Students' Educational Orientations (Morgan, 1991)

Orientation	Interest	Aim	Concerns
Vocational	Intrinsic	Training	Relevance of course to future career
	Extrinsic	Qualification	Recognition of value of qualification
Academic	Intrinsic	Follow intellectual interest	Choose stimulating courses
	Extrinsic	Educational progression	Grades
Personal	Intrinsic	Broadening, self development	Challenge, personal interest
	Extrinsic	Compensation, proof of capability	Pass the course
Social	Extrinsic	Have a good time	Social facilities and sport

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Concept 3: *Students' development as learners* relates to how students change and develop as learners as a result of their experiences of education. Säljo (1979) and Marton and Säljo (1984) in Sweden have (independently of the two studies) developed a scheme for studying people's concepts of learning. Five distinct concepts of learning were identified. Concepts 1, 2 and 3 are concerned with learning as an accumulation of information, the memorization of facts, and the learning of set procedures to be used in practice. In contrast, conceptions 4 and 5 describe learning as the 'abstraction of meaning' and as an 'interpretive process aimed at understanding some aspect of reality'. In the case of concepts 1, 2 and 3, learning is viewed as a relatively passive activity with emphasis on reproducing knowledge, whereas for conceptions 4 and 5, knowledge is actively constructed by the learner.

Concept 4: *Approaches to studying* relates to what students do when confronted with a particular learning task. Marton and Säljo (1976) identified qualitative descriptions of how students tackled the reading of academic articles. They identified the major distinction between a 'deep approach' and a 'surface approach'. The key variations in approach to study are summarized below. The significance of these approaches is that they are linked to different learning outcomes. If students concentrated on memorizing the facts and the details, seeing the tasks as externally imposed (a surface approach) they would end up with a poor understanding but with knowledge of detail. In contrast, if they intended to understand the material and interacted with the content of the text (a deep approach), they stood a better chance of getting the author's 'message'.

Deep Approach — Intention is to understand

- Focus on what is 'signified' (e.g. the author's arguments)
- Relate and distinguish new ideas and previous knowledge
- Relate concepts to everyday experience
- Relate and distinguish evidence and argument
- Organize and structure content
- Internal emphasis: 'A window through which aspects of reality become visible, and more intelligible.'

Surface Approach—Intention is to complete task requirements

- Focus on the 'signs' (e.g. the text itself)
- Memorize information and procedures for assessment
- Unreflectively associate concepts and facts
- Fail to distinguish principles from evidence, new information from old
- Treat task as an external imposition
- External emphasis: Demands of assessments, knowledge cut-off from every day reality.

Concept #5: *Learning outcomes* relates to what the students actually learned from a course of study. Research in learning outcomes has focused on learning from the teacher's perspective (scoring pass-level marks on tests, assignments, and examinations) and more importantly, from the student's perspective (how personal understanding of key concepts and ideas have changed a consequence of studying a course).

Results

Objective 1: Identify and describe the special needs of distance education learners who self selected the type of instructional delivery system within a College of Agriculture course.

Demographic Measures

Fifty-eight students completed the course out of an original enrollment of 60 (two students dropped the course with no reason being indicated). Of this enrollment, 32 students completed the course by videotape, 16 completed the course via the ICN system at one of three ICN receiving sites (10 at Rock Rapids, 4 at LeMars, and 2 Manchester), and 10 students received the course from the origination classroom.

Of this population, 6 videotape, 1 on-campus, and 4 ICN students for a total of 11 (19%) completed 1 or more of the three mini-diaries provided. Thirty-nine additional students provided partial demographic data for statistical

Table 1

Means, Ranges, and Frequencies of Selected Measures of Students Enrolled in Animal Science 511 During Spring Semester 1994 By How Instruction Was Received (N=58)

	How Instruction Was Received			
Measure	Face-to-Face (N=10)	ICN (N=16)	Videotape (N=32)	**Total** (N=58)
Age				
Mean	N/A	35.86	37.36	36.78
Range	N/A	27-43	27-48	27-48
TOTAL	0	7	11	18
Gender				
Male	8	16	29	53
Female	2	0	3	5
TOTAL	10	16	32	58
Martial Status				
Married	N/A	4	9	13
Single	N/A	1	0	1
TOTAL	0	5	9	14
Occupation				
Farming	0	3	2	5
Agribusiness	0	2	5	7
Extension	0	0	1	1
Ag. Teacher	0	0	1	1
Other (Student)	10	0	0	10
TOTAL	10	5	9	24
Enrollment Status				
Full-time	8	0	0	8
Part-time	2	11	28	41
TOTAL	10	11	28	49
Declared Major				
Professional Agriculture	1	3	11	15
Veterinary Medicine	9	0	0	9
Agronomy	0	0	2	2
Agricultural Studies	0	7	5	12
Undecided	0	6	13	19
Other (Business Admin.)	0	0	1	1
TOTAL	10	16	32	58
Reason for Enrolling in Course				
Pursuing a degree	8	1	3	12
Improve business/career	0	3	6	9
Personal interest	0	0	0	0
Other (combination)	0	1	0	1
TOTAL	8	5	9	22
Final Grade [1]				
A	8	2	12	22
B	1	7	11	19
C	0	0	1	1
Incomplete	1	0	3	4
Audited (no grade given)	0	7	5	12
TOTAL	10	16	32	58

[1] Final grades as of June 1, 1994

analysis with additional data collected on all students from course registration forms and Professional Agriculture Program files.

Student demographic data is displayed in Table 1. Students' age ranged from 27 to 43 years for ICN students, 27 to 48 for videotape students, with all of the on-campus students not reporting their age. Off-campus students were typically married while on-campus students did not indicate their martial status. The majority of the students in all groups were male.

ICN students were either engaged in farming or employed in an agribusiness other than farming and were taking courses part-time to improve their business or career performance. Videotape students were more often engaged in an agriculture business other than farming, considered themselves part-time students, and were divided on their reasons for enrolling in this course between wanting to improve their business or career performance and personally pursuing a degree. On-campus students were typically full-time students in the College of Veterinary Medicine and were enrolled in this course as a means to complete their studies.

Diary Concepts

As discussed earlier, the researchers adopted the concept terminology and definitions summarized in Morgan (1991) as a result of the identified similarities between this study's findings and the Morgan paper. Each of the five concepts are listed with excerpts from selected diaries to add further clarity as to the findings of this study.

Course Design and Assessment :
One of the sub-areas of this concept is "Difficulty in Studying." Two students commented on the difficulty of "getting going" with their studies:

> *"I just finished watching the next to last video--it's hard to get motivated to watch them but they always seem to go by fast."* —videotape student

> *"My expectations are more of myself than of the course. First & foremost is to keep up. Since I take this course from tapes it is easy to say 'I'll work on this another day when I'm not so busy."*—videotape student

Another sub-area of this concept is "Relationship of Assignments to Studying." One student provided this insight:

> *"After 1st two sessions I have been somewhat disillusioned with all the new technology and anatomy of cow but after working work problems I have been guided back on track.."*—ICN student

An on-campus student was very assignment conscious and expressed the need for additional clarification of assignment expectations as well as a question that the three delivery modes may mean different expectations:

> *"An understanding about exams and how information is to integrated for study. . . . . What are expectations? Are not really sure of level of learning expected. Is this to be more practical or research/academic? What are expectations of 'off-site students."*—face-to-face student

The sub-area most commonly identified in the diaries (in 8 of the 10 diaries) was "Dialogue and Feedback" with several comments related to turnaround time and the need for interaction. Comments included:

> *"The instructors seemed very willing to communicate, both during classtime and during other hours"*—ICN student

> *It would be nice if we could have a bull session--sort of brainstorming right after the class is over. . . Why can't it be set up so at 9:00 the lecture stops and then there is time for B.S. Those that don't want to stick around can just take off."*—ICN student

> *"Kind of wished I was taking the class via ICN during the question/comment period. Will just have to call later."*—videotape student

Two comments were provided in the sub-area of "Unaware of Course Demands" (prior to enrollment); both by videotape students.

> *"I think there will be more reading and studying than I expected"*—videotape student

The researchers received several diary comments related to how the instructors used the electronic technology as well as how the technology itself operated. This is likely due to the newness of the technology to both the teachers and the students. The researchers created a new sub-area entitled "Delivery & Instructional Technology" within the *Course Design and Assessment* concept.

> *"The extent to which telecommunications is able to reach many people at once. Amazing!"*—face-to-face student

> *"Just had 3rd class session last night. Dr. ______ had more technical problems with the equipment which was a little annoying at times. Maybe it would help if there was a technician sitting next to him to switch cameras back & forth, focusing, etc. That way the instructor can keep his mind on teaching"*—ICN student

> *"Enjoy watching them fumble with the new technology from time to time!"*—ICN student

> *"Finished tape over lunch. The by-products section seemed to get hurried to be over by the time they went off the air"*—videotape student

> *"I really like the video format—you can fit it into your schedule when you have the time—this also can prove to be a problem though!"*—videotape student

Orientation to Learning

Similar to the results of previous studies of distance education students, the two groups of off-campus students in this study frequently indicated their vocational orientation to learning; primarily displaying an intrinsic interest in the course

> *"While studying at ISU, I took only one nutrition class. Now my career as a Livestock Production Specialist requires that I have extensive knowledge of nutrition"*—videotape student

> *"I hope what is gained is applicable to our farming operation. Time will tell"*—ICN student

A lesser amount of academic orientations were found within the diaries but the comments were found in the writings of the off-campus students as well as the on-campus student.

> *"I took this class because it relates directly to my job, but also to see if I'd like the format—if I did, I was planning on taking more to get a master's. Well, I think I will take more classes"*—videotape student

> *"The lectures to date have certainly stimulated the 'gray matter'"*—ICN student

> *"This course fits well into scheduling into veterinary medical school"*—face-to-face student

Few personal orientation and even fewer social orientation comments were offered but those that were offered displayed the life of a part-time student and how little on-campus students may know of being a part-time student.

> *"My business here is being extended--I hope I get back in time to study better for the quiz."* (5 days later) *I'm trying to study in the car as we travel back home, but I'm getting car sick! I'm not sure I really have the time for this class--there are so many other things going on"*—ICN student

> *"Although I'm sure that Dr. ___ knows his material thoroughly, this delivery is very dry. It must be challenging for those in remote sites and viewing via videos. I have often wondered about the relevance of much of the presented material for "off-site" participants. Many of them, I assume, have a lot of practical experience."* —face-to-face student

Students' Development as Learners

A great deal of difference appeared in the diaries as it related to students' development as learners. Several students indicated that the content challenged them to develop to Conception level 3 (learning of set procedures to be used in practice) or higher (learning as '4' the 'abstraction of meaning' or as a '5' 'interpretive process aimed at understanding some aspect of reality'). However, the face-to-face students and others who were auditing the class provided conflicting views perhaps reflecting the diverse backgrounds and experiences brought to the class.

> *"We had class last night. The material was a little over my head--good thing I'm just auditing this class! . . . I like Math and trying to figure things out--It's the memory work I have problems with."*— ICN student auditing the class

> *"Basically the material covered was background information. Some of the content was new to me, but so far not much that was applicable out on the farm (or should I say in the feedlot)."* —ICN student

> *"Went to presentation today at Vet. School on problems in feedlot cattle and learned some very good applied information that I thought would have been covered in class."* —face-to-face student

Approaches to Studying

Of the diaries that indicated how students were confronting the content of the course, nearly all of the students indicated a deep approach to the materials as they sought to understand and apply the reading material. The comments included how the students are taking advantage of the technology as they seek a deeper understanding.

> *"The advantage of the video . . .and go back over it if you missed something or didn't understand it the first time."* —videotape student

> *"To date, Dr.______ lectures have been more complex and harder to follow as his handouts are not as inclusive as Dr. _______ --thus more note taking tends to interrupt my concentration on the lecture."* —ICN student

Learning Outcomes

Only one student provided comments that related to what the student actually learned from this course of study. The comment reflects that the teachers' outcomes may have been met but not necessarily the student's.

> *"I just watched the last video! It's over now except for the final. I know the final would be something like this. It seems like some people will have an advantage on this--but I have to look at it this way--it will definitely be a learning experience! This will be the first time I have ever formulated a ration, but this is what I expected to get from the class. I kind of expected more applied information from class though like an example of ration formulation like they're asking us to do in the final. I don't have any idea where to even start."* —videotape student

Objective 2: Compare the students' performance to the type of instructional delivery system chosen.

Students receiving face-to-face instruction realized higher final grades than students by either of the off-campus delivery systems. Eighty percent (80%) of the face-to-face students who completed their studies achieved an "A" or "A-" grade while only 46% of the videotape students and 22% of the ICN students were able to achieve this level of academic performance. Using SPSS 'Crosstabs' to compare the students' course performance to the instructional delivery system they utilized. Analysis revealed a .33 relationship (p>.12) between chosen instructional delivery system and a student's final course grade. These results are displayed in Table 2.

Objective 3: Compare the students' performance to the special needs and demographic measures identified in Objective 1.

No significant relationships between students' course performance and the diary concepts identified was revealed by the data analysis. It is likely that the low number of diary participants negatively impacted the statistical power. In two demographic measures, where a larger "n" was present, important linear relationships were found. These results are displayed in Table 3.

All full-time students received an "A" as their final grade while 14 (39 percent) of the 36 part-time students enrolled for credit (excludes students auditing the course) received an "A" as their final grade. Using SPSS 'Crosstabs' to compare the students' course performance to their enrollment status revealed a .47 relationship (p>.008) between enrollment status and final course grade.

Students who enrolled in the course as a means to complete a degree were more likely to receive an "A" (10 out of 11 students or 91 percent) than were students who enrolled in the course as a means to improve their business or career where 5 out of 10 students (50 percent) received an "A." Using SPSS 'Crosstabs' to compare the students' course performance to their enrollment status revealed a .46 relationship (p>.11) between enrollment status and final course grade.

Conclusions and Recommendations

Obviously, with a small sample of students, any conclusion must be cautious. However, this type of qualitative research does provide generalizability as the findings were similar to a previous study and in the sense that these experiential summaries can provide a relevance and/or increased awareness to the reader or users of the findings as they address parallels within their own context.

The results of this study did not provide particularly powerful insights into how future course offerings should be structured for multiple media delivery or if simultaneous delivery by multiple media forms should be continued. Conclusions made from the analysis of the demographic data and course data and the qualitative analysis of the diaries are as follows:

1. Student diaries revealed several concepts, both intrinsic and extrinsic to the student, about course design and assessment, the students' orientation to learning, how students developed as learners, how students approach studying for the course, and how learning outcomes differed between teacher and student.
2. Off-campus students (those who received the course content via ICN or videotape) are typically part-time students and are in some form of employment including entrepreneurship whereas on-campus students were enrolled full-time.
3. Off-campus students expressed difficulty in managing studies with work, family, and social obligations more often than on-campus students.
4. Off-campus students were unable to achieve at the same level of performance as on-campus students (those who received the course content by face-to-face course delivery).
5. There was no relationship between concepts expressed by students and their final course performance though this was likely due to low statistical power.
6. Diaries are fruitful sources of information but are not the best method of qualitative data collection with this group of students as busy schedules often made diary writing a low priority.

The following recommendations can be made from the aforementioned conclusions.

1. Additional research is needed on distance education course delivery conducted simultaneously with traditional on-campus face-to-face delivery.
2. Text of these diaries should be shared with future distance education instructors as they prepare for content delivery. An increased awareness may be gained from the text thus improving distance course design and delivery. Assistance should be offered to the distance instructor to prevent any possible bias towards on-campus students.
3. Assistance should be provided to help off-campus students better manage their studies. This could include formats such as student handbooks with studying techniques and suggestions, creation of regional study centers and discussion groups, and alternative forms of studying assigned reading material (such as audio books).
4. Other methods of qualitative data collection or multiple methods of data collection should be considered that are less obtrusive to the participant.

Discussion

The diaries used in this study generated responses from a small sample of students, a result partially due to the personal, academic, and vocational time requirements of students, and also through the lack specificity on how to respond in a diary. However, this study does provide food for thought to future distance educators.

Course design and assessment is one of the key areas where distance educators and educational technologist have some scope for influencing how students go about their studies (Morgan, 1991). The use of multiple delivery technologies was of interest and concern to the students in this study thus warranting a new sub-area being added to those defined in Morgan's review of research on student learning in distance education (1991). Distance educators and educational technologists must be aware that poor handling of the technology is a noticeable distraction to the students and may impact their learning. As universities struggle in their increased roles in distance education, a priority for research in distance education should be to improve our understanding of students' experiences of course design and assessment and its impact on student learning and technology transfer.

Morgan (1991) proposed that in terms of research, the conception of orientation can be used to develop typologies to describe more of the detail of what students hope to gain from the course. In terms of instructional design, a deep understanding of the variations in orientation to learning between on- and off-campus students will only enhance a universities ability to disseminate information and transfer to technologies to all learners. Morgan added the following as a reminder of students' subjective perceptions of their studies:

> "Often teachers and distance educators seem to be unaware of the very different orientations held by students. It is often assumed that students are engaged in study for the single reason of studying the subject and gaining the highest grades in assessment. . . .However, the studies on orientation provide a strong reminder of the complex mixture of reasons that students—especially adult students—have for continuing their education" (p. 4).

Morgan, in his summary of student learning in distance education stated; "The importance of students' development as learners or their conception of learning is that it appears to have a limiting influence on what students will do when tackling a particular learning activity" (p.7). The diary entries of this study did not support nor dispute this statement but did indicate that this graduate-level course was designed and delivered at a level above the mere accumulation of information or memorizing facts—perhaps more reflective of the teachers' desired outcomes.

The importance of the approach to study is that it is directly linked both empirically as well as logically. Helping students to engage in a deep approach is therefore a crucial issue for all teaching and learning (Morgan, 1991). In this study, especially in the off-campus students, a deep approach to studying was evident. Is there a link between vocational orientation (dominant in off-campus students of this study) and their approach to studying? This could be a crucial research question to distance education, especially in instructional design decisions.

Learning outcomes asked students to explore the content of learning from their perspectives. While the instructor determines successful mastery of content through passing-level marks on tests, assignments, and examination; the off-campus student may determine mastery by their ability to utilize the course content within their business, career, or personal life. Distance educators and educational technologists should give strong consideration to the desired learning outcomes of the distance student and consider assessment alternatives that will allow the learner to visualize success on their terms.

The use of diaries in this study would not be viewed as a success in terms of participation—even though the information gained from the limited participation further supported previous research finds. However, off-campus students are typically balancing their time between a full-time career or business, a family, and their need for continuing education. Writing in a diary is likely viewed by students as a time robber versus a means to reflect on their studies. Diaries themselves do not encourage students to be reflective about their studies. That motivation must come from another source.

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Table 2

Relationship of Students' Course Performance to Instructional Delivery System Chosen

	Final Course Grade (as of 6/01/94)				
Measure	"A"	"B"	"C"	"Incomplete"	**Total**
Delivery System [1]					
Face-to-face	8	1	0	1	10
ICN	2	7	0	0	9
Videotape	13	11	1	3	28

[1] Cramer's V=.33191, p.=.11045Table 3

Table 3

Relationship of Students' Course Performance to Selected Demographic Measures

	Final Course Grade (as of 6/1/94)			
Measure	"A"	"B"	"Incomplete"	**Total**
Enrollment Status [1]				
• Full-time	8	0	0	8
• Part-time	14	18	4	36
Reason for Enrolling [2]				
• Pursuing a degree	10	1	0	11
• Improve business/career	5	4	1	10

[1] Cramer's V=.47140, p=.00753

[2] Cramer's V=.45925, p=.10920

Cedar Falls Harp Project: Music Instruction on the Fiber Optic Telecommunications Network

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Introduction

Cedar Falls Community Schools District is one of only a few in Iowa which offers harp in the string orchestra program. I have three harp students at Peet Junior High School. Laurie Busch, Malcolm Price Laboratory School orchestra instructor, has an eighth grade harpist. When our harp instructor, Dr. Mary Beckman of the University of Northern Iowa, retired last June, her position in the School of Music was eliminated. This left us with no private instructor. Professor Beckman recommended Kristin Maahs Fallon of Des Moines as her successor, though a hundred miles separated the towns.

On alternating weeks when Kristin did not drive the distance, she conducted harp lessons with our students on the Iowa Communications Network. She only needed to travel a few miles from her home to the Iowa Public Television station in Johnston. The four harp students were transported by their respective parents to the Schindler Education Center Distance Education Classroom at UNI. Lesson times were prearranged with Kristin, the students, and regional network scheduling coordinators Julie Johnson at IPTV and Dr. Robert Hardman at the UNI Media Center.

Standard Operating Procedure

One harp was transported to the UNI studio on alternating Wednesdays for four twenty-minute lessons scheduled 3:00-4:20. Technicians monitored the connection between the sites which is programmed and controlled by computer at the main network hub at Camp Dodge. If any problems arose there was a "Hotline" phone and number which allowed technicians to quickly communicate. Both origination site and receiving site had three or four cameras and monitors to allow both to continually see one another. Parties at each site were responsible for managing their respective signals.

I acted as facilitator behind the teaching station at the front of the classroom working the touch screen computer controls for focus, zoom, and camera selection, and pressing the microphone switch when the students played or spoke. The students also had a nearby switched microphone on which they could speak. A small monitor in the teaching station desktop showed what image was being sent to the other site allowing me to choose and set controls as we proceeded. The origination site audio was set to continually send. The originating instructor's audio, though, was cut off whenever our receiving site microphone switch was pressed down. Close attention was required for me to know just when to operate the switch.

At a recent lesson our technician was able to set up our sending sound so it would remain engaged. This relieved me of that duty, unless I needed to speak to the instructor on a switched microphone. In his terms, he "removed the by-pass (mute) on the Local Node Control (touch screen), turned down #4 mike on the mixer to "0", attached a remote lavaliere microphone to the player's lapel, and carefully adjusted the volume level down to minimize feed-back." He admitted this was somewhat creative, and expressed doubt that most sites could modify their setup like this because the controls are usually not as easily accessible. Nevertheless, it was a great improvement to our overall effectiveness, spontaneity, and interactiveness.

The cost of the ICN connection was $5 per hour. Instructor fees and travel costs were covered by a combination of student payment and grant funding sources.

Teacher Attitudes and Strategies

The harp instructor, Kristin Maahs Fallon, responded to a list of questions by the author.

Question 1:
What teaching strategies worked well on the new fiber optic telecommunication system?
Answer: The teacher can play a portion of the piece the student is studying to give examples of how to play, [offer] interpretive ideas, and ask the student which example is better than another.

Question 2
What strategies, approaches, and methods in your instruction needed to be altered or compromised? How did you accomplish this?
Answer: It was important that I indicated measure and line for students to work on, and that they

understood where I meant. It took longer to indicate a place in the music than if the lesson was live with teacher and student in the same room.

Question 3
What teaching strategies were hampered?
Answer: Playing together the student can hear the teacher, but the teacher cannot hear the student when playing or talking. Getting the camera [framed] on the harp and teacher.

Question 4
What significant problems were encountered? How did you manage them?
Answer: The scheduled time was a problem at first. Then we were able to get a guaranteed 3:00-4:20 time. We have had no problems since this was settled.

Question 5
How do you feel about using this method? Have some of your feelings changed since the beginning?
Answer: I feel this system of teaching is a good means to connect student and teacher, but I also believe that the best [situation] is when teacher/student are in the same location. Yes, my view is that it is a temporary situation in which the Waterloo/Cedar Falls area (UNI included) needs to have a harpist living in the area to resolve the situation.

Question 6
What suggestions would you have for improving the system's effectiveness?
Answer: A voice-activated microphone for the students at the UNI site. A technician to assist me at the Johnston site when I arrive.

Question 7
Do you think harp instructors with only a few students would want to use this approach to expand their studio?
Answer: Yes. However, I feel only about half of the lessons should be televised. The rest should be live for best results.

Other comments?
Answer: I believe the University of the Northern Iowa must continue a harp instructor position in order for the Waterloo/Cedar Falls Symphony and the public school programs to continue in the future. I am well rooted in Des Moines, but I am willing to help the situation in Cedar Falls for some time.

Student Attitudes

Our students enjoyed doing something new, though at first they seemed more apprehensive about the new setting, which could be expected. They adapted well and soon acquired good television presence and comfort level. A contributing factor to the degree of ease the students felt is whether others were in the room. The less of an "audience" that was present, the more at ease they became.

Also, while we were getting glitches out of the system, some technical problems hampered early lessons which was counterproductive to student and instructor motivation and confidence. Operations improved with time and practice. Generally, the students felt they would like to continue using this approach on alternating weeks. The junior high students, two beginners and two relatively advanced players, responded to the following:

Question 1
How do you feel about having harp lessons on television every other week?
Answer: I enjoy it (1)
It's all right (2)
I'm a bit uneasy about it (1)
I dislike it (0)

Question 2
Has it become a bit easier each time you do one?
Answer: yes (2)
a little (0)
not much (1)
no (1)

Question 3
Are you able to see and hear the instructor well?
Answer: yes (1)
usually (3)
not much (0)
no (0)

Question 4
Do other things distract you during the televised lesson?
Answer: no (1)
some (2)
quite a few (0)
yes, a lot (1)

Question 5
Is it fun?
Answer: yes (1)
mostly (1)
not much (0)
no (2)

Question 6
Do you feel you are improving in your playing with these TV lessons?
Answer: yes (0)
somewhat (4)
very little (0)
no (0)

Question 7
Would you like to continue using this method?
Answer: yes (2)
maybe (2)
probably not (0)
no (0)

Question 8
What do you think are the major problems involved with this system?
Answer: - None, except for being able to talk and listen at the same time.
- Not enough time
- We aren't always coordinated
- Bringing the harp every three weeks. I'm always last, so it seems like I don't get as much done as others.

Question 9
What do you think would make it better?
Answer: - Nothing
- More time
- No extra people
- Not having extra people around

Problems and Solutions

The type of problems that arose were usually relatively small and manageable.

Logistical: Arranging university parking passes for drivers, transporting the harp, setting the camera angles for the players, and experimenting with microphone placement are examples of what was needed. The parents and I took turns transporting the harp.

Technical: Our technicians, Emrys Pugh and Nathan Fisher, solved operating problems including reconnecting the link when it was lost, clearing up a discolored picture, and communicating with the sending site about any concerns, such as picture quality, sound levels, and initiating the connection from an adjoining room. Kristin, though, was sometimes without technical assistance at the IPTV site. The greatest hindrance was for me to operate the microphone switch with somewhat intuitive timing. When our technician creatively solved this inherent drawback, our efficiency level jumped.

Scheduling: Since the Iowa network was activated in late August, requests for user times have far exceeded the capacity to accommodate them. The respective regional directors met to hammer out solutions, prioritizing the overwhelming number of requests. The schedule is totally unforgiving in terms of use. When the allotted time has expired the television screens switch back to the test bars pattern and audio is cut off, bringing an abrupt halt to the period. Parties at both sites must watch the clock carefully and alert one another before the cutoff time to allow an appropriate closure to the lesson. Rotating the lesson times helped assure that the same student would not always be last.

Interruptions: In order for the lessons to proceed smoothly, interruptions and distractions needed to be minimized. I felt my role as facilitator was to say as little as possible to the students or instructor during the lesson, to operate the controls adeptly, and do whatever I could to put the students more at ease. People not directly involved in the lessons seem to be somewhat distracting and affected the students' focus.

Benefits Gained

For the harp instructor wishing to reach students over a distance, this is an effective method to connect with them. One could assert that this approach cannot completely replace the personal spontaneity of a live music lesson. I would generally agree at this point. However, I noted the students usually gave extra effort to focus on the screened instructor. Today's young people are tuned in more to electronic media like television, computers, and video games. Instructors can take advantage of this high-tech mindset. The school string program naturally benefits from the continued studies of harp players who provide a special musical color for the orchestra.

Also, because harp playing involves easily visible external motions and produces a tone which can easily be transmitted and discerned, this televised method seemed to work relatively well. Other stringed instruments can be televised as well. A cello student at Wartburg College in nearby Waverly took lessons on the network from Professor John Ehrlich at Drake University in Des Moines with notable success. Other instruments requiring more internalized motions might not be as adaptable to television as the stringed instruments, but all instruments can be successfully applied to some degree.

Summary

Like a new car, the fiber optic technology required a little time to just get comfortable with; operating a few video and audio buttons, adjusting camera angles, positioning players and furniture. Practically anyone could do it. The technicians managed the primary equipment and monitored the connection. Because of the high quality audio and picture, the instructor or students soon felt at ease and carried on almost normally.

Our students and instructor served as musical pioneers on the Iowa Network, and tolerated some observers and a few early glitches. School orchestra directors who want to enhance their string programs by adding harpists, or connecting other string players with private instructors located elsewhere should consider this fascinating effective new tool when and where the network telecommunication links are available. Harp teachers who have the problem of reaching students across distances should seriously consider using this new technology to expand their music studio in today's Information Age.

Acknowledgments: Dr. Mary Bozik, UNI Communication Studies Prof.; Dr. Robert Hardman, UNI Ed. Media Center Director; Julie Johnson, IPTV Educational Programming Director; Sharon Smaldino, UNI Curriculum & Instr. Assoc. Prof..; Emrys Pugh, UNI Senior Television Engineer; Nathan Fisher, UNI Television Technician.

Assessing the Roles of Participants in Multi-Site, Foreign Language Instruction: Interaction in a Technology-Mediated Environment

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Introduction

Fiber-optic Networking in Education

Recently in the state of Iowa over 100 schools have been linked to universities, colleges, government agencies, the Internet, and global satellite down-linking facilities through a newly installed, state-wide, fiber-optic network. An understanding of the full potential of the network is, perhaps, still beyond the grasp of educators at present. What is emerging, however, as those of us involved in its inception begin to research its role, is a picture of possible long-term, dramatic change in some of the fundamental characteristics of education.

Such a change was initiated some twenty years ago with the mass-marketing of low-cost, desk-top computers, and is being consolidated today through fiber-optic transmission technology. Fiber-optic networking combines powerful audio, video, and digital technologies within a single communications system of rapid, high quality data transmission. It enables teachers, learners, and other participants in the educational process rapid access through world-wide communications facilities to varied resources such as electronic databases, and potential remote collaborators and experts. Such communications may be dynamic, live, and interactive, or consist of text and graphic materials.

More significantly for the present purposes, the network purports to facilitate two-way, real-time, interactive instruction across geographically disperse sites through audio, video, and digital channels of communication. With such facilities, a radically different interpretation of the time and space of the classroom emerges. It begins to suggest the merger of mainstream education (traditionally composed of single-site, full-time learners) with distance education (traditionally catering to the marginal needs of part-time, employed, adult, or extra-mural learners), the merger of the educational world with the commercial world, and of home-based learning with classroom-based learning.

For foreign or second language (L2) pedagogy, the claim that fully interactive instruction is possible in a multi-site environment is a particularly crucial contention. Contemporary L2 instruction is intimately linked to the notion of interaction (see, for example, Omaggio, 1993, and her discussion of the L2 proficiency curriculum): it is at once the goal, the medium, and the content of L2 acquisition. Allwright (1984), for example, maintains that the provision of interactive activity in the L2 classroom facilitates the transfer of skills to the real world, enhances the acquisition of communicative skills and of formal knowledge of the L2, involves learners in the learning process, and is particularly effective when conducted through peer group activities. Ellis (1980) further supports the need for an interactive or communicative L2 pedagogy through comparisons with L1 child acquisition research which shows that communicative activity affects both the rate and the route of L1 acquisition.

Since the demise of the behaviorist-inspired audio-visual and audio-lingual methodologies of the 50s and 60s, an L2 curriculum based on the acquisition of performance skills in the L2 has been gradually defined and widely accepted in the profession (although perhaps not always as widely practiced). It is, then, of crucial importance that any multi-site, technology-mediated environment for L2 instruction be at least as effective at enhancing interaction as a single-site environment. Research needs to investigate and corroborate the claim that this is indeed possible.

Multi-site Technologies in L2 instruction

Multi-site technologies in L2 instruction are not new. Figure 1 indicates the range of technologies (used either independently or linked with each other) and their interactive capabilities that are documented in the L2 literature (see, for example, Johnson & Iten, 1984; Kataoka, 1986; Eddy, 1989; George, 1989; Wohlert, 1989; Gallego, 1992; Perrin, 1992; Yi & Majima, 1993). These technologies predominantly concern satellite and cable broadcast, all of which have helped to supply educational needs to under-served populations, or to increase learners' dynamic exposure to native speakers of the L2 and their

culture. They have, however, been characterized by a number of problems which have somewhat limited their pedagogical effectiveness and scope:

1. many do not provide complete 2-way audio and video interactive communication;

2. remote-site learners are typically at a disadvantage compared to origination-site learners;

3. some systems are open to public access;

4. some systems require studio presentation of instruction;

5. many are engineer, rather than teacher, controlled;

6. they involve narrow-band data transmission, limiting interactivity by kind, speed, and quality.

Fiber-optic networking, as Figure 1 suggests, provides a two-way, interactive communications system which is of greater speed and flexibility, of higher quality, and of greater range of data transmission potential than earlier technologies. As such, many of the earlier problems now appear largely negligible:

1. interaction is fully 2-way audio, video, as well as digital;

2. consequently, remote-site learners are in a more favorable situation vis à vis the origination-site learners than with earlier technological systems;

3. fiber-optic networking is a closed access facility;

4. the system does not involve the teacher in a studio-prepared presentation of instruction;

5. the technology is completely teacher controlled;

6. fiber-optics provides a broad-band network with multi channels of simultaneous video transmission, as well as audio and digital channels of communication.

Purpose Of The Present Study

One of the most frequently voiced criticisms of technology-mediated, multi-site instruction concerns its ability to facilitate interaction across geographically disperse sites. Warriner-Burke (1990) concludes that in distance learning: "Interaction between and among students is rendered extremely difficult" (p.130), while Arendt and Warriner-Burke (1990) are even less optimistic: "Interaction between teachers and students is in practice minimal or non-existent" (p.451). Davis (1988) maintains that:
"The problems most common to distance educators include encouraging student-teacher and student-student dialogue...(which is) exacerbated in many distance education programs because of the inflexibility of some prepackaged materials, the normal time-lapse between initiation and response and the frequent isolation of the student from the learning group" (p.548).

These personal observations clearly reflect a genuine concern that the technologies of multi-site instruction may not be adequate for the objectives of a proficiency based L2 curriculum. However, given that fiber-optic networking provides a more powerful, more flexible, and more extensive means for interactivity in the multi-site environment, are the commonly voiced criticisms leveled at L2 distance education still valid? Can interaction of a quality and frequency typical of single-site L2 classrooms be generated and sustained on a fiber-optic network? In the almost total absence of evidence from research regarding the effects of multi-site technologies on L2 instruction, the claim that the widely accepted tenets of the L2 proficiency curriculum cannot be achieved in the multi-site environment remains an untested assumption.

Any research agenda which aims to assess the effectiveness of multi-site technologies for L2 instruction must address the issue of the role they play in supporting and sustaining interaction. This must be done in theoretically defined and measurable terms such that comparisons can be carried out with other multi-site L2 research projects or with non-distant programs. In light of this need, and with reference to L2 instruction via 1) a two-way audio/one-way video microwave system, and 2) the newly installed fiber-optic network in the state of Iowa, the present research study considers and applies a methodology for describing interaction in multi-site, technology-mediated environments. The methodology will facilitate an operational definition of 'interaction' in terms of parameters and their sub-categories, and the identification of strategic behavior on the part of the various participants in generating and sustaining interaction.

A Conceptual Definition of Interaction

Central to the present research study are the concepts of 'interaction' and 'communication', as used within the field of L2 pedagogy. Clear definitions of the two terms, either of a conceptual or an operational nature, typically do not appear in the pedagogical literature. Allwright (1984) argues that of the four justifications which he cites for the integration of communicative activities in the L2 classroom, only the last one uniquely involves live, person-to-person encounters, while the other three include interpretations of 'communication' where non-interactive work may be taking place (with audio or written text stimuli, for example). Thus, 'communication' suggests the expression of a message to a specific audience, which may be transmitted by oral or written modes and by live or recorded media, but does not entail exchange of reactions. It is the successful transmission of a message and is achieved, for example, when somebody reads and understands an advertisement posted on the side of a bus, listens to and decodes an item of news on the television or information transmitted by a teacher in the classroom. 'Interaction', on the other hand, specifically concerns the dynamic and integrated, verbal or non-verbal actions and reactions of all participants in a communicative event, described by Malamah-Thomas (1987) as "a constant pattern of mutual influence and adjustment" (p.7), and by Allwright (1984) as "this joint management of learning" (p.156). It is this two-way, dynamic participation in communication - i.e., interaction - that forms the basis of an effective pedagogy for L2 instruction, and is the object of analysis in the present research study.

Interaction is composed of various characteristics which may conceptually define the term. Three features were considered of particular interest for the present study. First, the coding and decoding of a message is facilitated by the existence of shared, extra-linguistic, contextual features in interaction. These contextual features may range from gestures and other non-verbal behaviors of any of the participants in interaction, to dynamic as well as stable situational characteristics. Such features help speakers and listeners in live, face-to-face interaction in the coding and decoding process. For L2 speakers and listeners involved in L2 interaction, contextual clues, whether of a gestural, facial, or broad situational type, are of crucial importance because they provide information which may not be understood at the linguistic and supra-linguistic levels. Altman (1989) describes the importance thus:

"As any language learner knows, this added nonlinguistic channel is often paramount in the process of understanding. A difficult message can be made accessible with no more than a few hand signals that confirm or modify the contextualizing indicators provided by the text itself" (p.9).

Of particular importance to the present study is the assessment of whether such contextual clues are available to all participants in a multi-site, technology-mediated environment for interaction.

A second crucial feature of interaction is what the literature describes as 'negotiation of meaning' (for L1, see Brown & Yule, 1983; for L2, see for example, Allwright, 1984; Ellis, 1984; Long, 1983). Typically classroom interaction is characterized by roles which involve the teacher in 'directive' behavior and the learner in 'compliant behavior' (Allwright, 1984), the former composed of questioning, informing, and directing strategies, the latter involving verbal responses, non-verbal reactions, acknowledgments, and frequently passive behavior. More typical of interaction in non-classroom environments is a mode of participation known as 'negotiation of meaning', in which the verbal actions of one speaker evoke reactions in a second speaker which then influences his/her subsequent action. In reference to L2 interaction Ellis (1984) has described this as "vertical collaborative construction of meaning". Research in L2 acquisition indicates that negotiated meaning in the L2, especially through small-group or paired activities highlighting peer interaction, positively affects L2 acquisition (see Long, 1983; Pica & Doughty, 1985; Schinke-Llano & Vicars, 1993). Interaction including the feature of negotiated meaning must also be facilitated in the multi-site, technology-mediated environment if it is to be considered effective for L2 instruction.

The third feature of interest to the present study which characterizes interaction is that of input. Input is the complete linguistic and non-linguistic signal within which a message may be embedded, and may be derived from any of the participants in interaction, or from non-dynamic, technology-mediated sources. Much research has been conducted to assess the type of and extent to which L2 input may correlate positively with L2 acquisition (see Chaudron, 1988, for a summary of this research). Of particular relevance to the study at hand is the extent to which input is made available to all participants in interaction within an environment that is not uniquely face-to-face and is always technology-mediated for most of its participants.

Research Questions

The conceptual framework underlying the present research thus highlights interaction for a proficiency L2 curriculum as being composed of three crucial features: non-linguistic context, negotiated meaning, and availability of input. This study attempts to assess the extent to which these features are characteristic of interaction in multi-site, technology-mediated L2 instruction, specifically within a two-way audio/one-way video microwave system for the first phase of the study, and within the fiber-optic network of the state of Iowa for the second phase of the study. The research questions that guided this study are:

1. To what extent are the non-linguistic, contextual features of interaction made available to all participants in multi-site, technology-mediated, L2 instruction?
2. To what extent is interaction composed of negotiation of meaning?
3. To what extent is input made available to all participants?

Method

Given the mainly linguistic focus to the questions posed in this study, a discourse analytical framework, as opposed to an interaction analysis framework, was selected for the design of the instrument. Interaction analysis methodology can best be viewed as focusing on contextual issues to classroom behavior with the verbal content forming part of the context. Discourse analysis, on the other hand, considers the structure of the verbal content with para-, and non-linguistic information playing a supporting role. In light of this distinction, Sinclair and Coulthard's (1975) framework for discourse analysis, which offers a complete, functional-structural descriptive tool in the character of Hallidayan grammar, forms the basis of the instrument designed for this study. The Sinclair and Coulthard model revolves around a hierarchy of analytical levels moving from the act, at the lowest level, through moves, exchanges, and transactions. Each rank is composed of units of the lower level. Transactions may be considered as roughly analogous to distinct pedagogical stages within the lesson, while acts represent minimal units of functional significance. From a methodological point of view Sinclair and Coulthard's analytical framework is somewhat complex to apply, but with thorough training of raters the rewards obtained from its use well compensate for efforts expended in preparing suitable coders.

In addition to the levels of analysis determined by the Sinclair and Coulthard tool, the following parameters were included in the final instrument to capture other aspects of the technology-mediated, multi-site, instructional process: participant (teacher, student, remote-site facilitator), location of participant (origination-site, remote-site), technological medium (camera focus, supplementary audio, supplementary video), linguistic or paralinguistic medium (L1, L2, L1+L2, gesture), and length of time of transaction. All parameters of analysis were applied to linguistic and paralinguistic data obtained from video-tape observation of Russian classes taught during the spring semester of 1994.

Phase 1: Microwave Broadcast Russian

Phase one of the study was guided by two objectives: 1) to acquire preliminary evidence of reliability and validity in support of the use of the instrument; and 2) to respond to the research questions in respect to L2 instruction carried out on a different technological system to that of the second phase of the study. The first phase of the study was conducted deriving on-line, video-taped data from a Russian level 1 high school class of 40 minutes in length taught on a microwave system. The microwave broadcasting system provided teacher operated, two-way audio and one-way video communication between origination and remote-sites; the students in the remote-site were thus able to receive a video signal from the site of origin of instruction, but the teacher did not receive a return video signal. The observed class originated from a large, urban high school and was made up of 14 students (11 males and 3 females, consisting of 9 freshmen, 2 sophomores, 2 juniors, and 1 senior, with mean age = 15). It was linked to 3 small, rural high school remote sites with a total of 6 students present (2 male sophomores at 2 sites, and 4 8th. grade females at the remaining site, with mean age = 14.7). No moderators were present at the remote sites. The instructor was a female practicum teacher with self-reported advanced skills in spoken and written Russian. Her overseeing teacher was an experienced distance instructor of Russian.

Three raters were selected from the graduate population of the Department of Foreign Language Education at the university where the research was being conducted. They were chosen on the basis of the range of specializing languages they exhibited (Japanese, Russian, and Spanish), their L2 education experience, and their willingness to participate in the study. After approximately seven hours of training using the Sinclair and Coulthard framework for discourse analysis, the three raters were asked to code, independently, over a period of three weeks, and at the 'act' level of analysis, a linguistic and para-linguistic transcript of the pilot data. Raters were supplied a copy of the video-tape with the written transcript. Using a coded version prepared by the present researcher (whose professional background includes extensive applied linguistic training) as the standard measure, contingency tables were constructed to assess the degree of criterion-related agreement (Frick & Simmel, 1978) between the coders and the criterion measure. Raters were then asked to carry out two further tasks: 1) to provide a single, coded version of the transcript based on agreement between the three raters, and to be used to respond to the second of the two objectives above; and subsequently, 2) an independent coding of a randomly selected portion of the discourse (representing 12.1% of the total transcript), which was used to assess the stability reliability of raters' coding after four months of practical exposure to the analytical tool. Levels of analysis of the raw discourse data above the level of 'act' were derived from the raters' joint rating of the transcript, as were the data for the remaining parameters (participant, location of participant, technological medium, linguistic or paralinguistic medium, and length of time of transaction).

Results of the assessment for evidence of reliability and validity are now presented, while results derived from phase one of the study regarding the research questions are left for comparison with phase two data in the results section of this paper. With respect to measures of reliability and validity of the Sinclair and Coulthard tool, criterion-related agreement figures obtained from the first independent coding task and based on a corpus of 851 acts were $\underline{P} = 0.55$, 0.42, and 0.48 for each of the three raters A, B, and C (see Light, 1971, for the analytical procedure). Inter-rater agreement was calculated at $\underline{P} = 0.33$. On the second task in which raters were asked to produce a coded version of the data which represented 100% inter-rater agreement, agreement with the same criterion measure was $\underline{P} = 0.83$. The third task involved raters in an independent coding of a randomly selected section of the transcript. Criterion-related figures for this task were $\underline{P} = 0.69$, 0.80, and 0.83, on a corpus of 103 acts, while inter-rater agreement was calculated at $\underline{P} = 0.70$. When intra-rater agreement was calculated between individual scores on task 3 and scores on the same section of the transcript from task 2 used as criterion, agreement rates were $\underline{P} = 0.67$, 0.80, and 0.86. Thus, figures indicate an expected low criterion-related agreement after the initial coding task. Inter-rater agreement at $\underline{P} = 0.33$ was also predictably low, suggesting considerable random application of many of the 25 'act' categories of the instrument. After four months of training and coding, intra-rater measures achieved across task 2 and task 3 indicated stable use of the instrument, while criterion and inter-rater levels of agreement have each converged to a more reasonable, if slightly low, rate ($\underline{P} = 0.85$ and above being considered as an acceptable level of agreement according to Light, 1971). This convergence of ratings, obtained through training over time, suggests that the instrument can be used to adequately capture distinctions in the verbal and non-verbal behavior of participants in classroom-based interaction.

Phase 2: Fiber-optic Networked Russian

Phase two of the study was conducted using a level 3–4 Russian class taught on the fiber-optic network in the state of Iowa. On-line, video-tape data was derived from the origination-site, while at the remote-site video-tape data was captured by live filming. The additional camera located in the remote site was assumed not to have had any contaminating effect on the data since students were accustomed to being filmed during their fiber-optic networked, Russian classes. The observed class, of 30 minutes in length, originated from a small, urban high school and contained 9 students, linked to one rural, high school remote site with a total of 7 students present. A female facilitator employed specifically for the task of facilitating distance instruction was present at the remote site. The teacher at the origination site was male, with nine years of experience as a Russian instructor, including one year in distance education. The observed class involved specific focus on the linguistic needs of a sub-group of students (two at the origination site and two at the remote site). The remaining students participated in group work which was not monitored by the teacher during this class.

Results

General Characteristics of Interaction

Table 1 presents a synthesis of the data relating to the general characteristics of interaction in a two-way audio, one-way video, microwave Russian class compared with a fully interactive, fiber-optic Russian class. Frequencies and percentage proportions are indicated in respect of the major categories of the Sinclair and Coulthard discourse analytical tool (acts, moves, exchanges, and transactions), together with the parameters of participant (T = teacher, S = student, F = facilitator), location of participant (remote site, origination site, participants from both sites), and linguistic medium (Russian, English).

Question 1: Contextual Features of Interaction

Table 2 shows the relative frequencies and percentage proportions of data relative to research question 1: the extent to which contextual features of interaction are made available to all participants in multi-site, technology-mediated L2 instruction. Contextual features of interaction are measured by 1) acts supported by non-linguistic information. This type of information almost exclusively concerned teacher behavior and mainly consisted of gestures aimed at clarifying teacher use of the L2 (e.g., using fingers to denote the days of the week, pointing at watch when making a question related to time), and physical behavior that accompanied class management (e.g., pointing at sections of text, clapping in support of feedback, making camera changes); 2) acts which are conveyed exclusively through non-linguistic information (e.g., shaking and nodding head, nominating a student to reply by pointing); and 3) the technological media used to mediate interaction.

Question 2: Negotiation of Meaning

Results relative to research question 2--the extent to which negotiation of meaning characterizes interaction in multi-site, technology-mediated L2 instruction--is summarized in Table 3. It presents frequencies and percentage proportions of acts in terms of category of act. Sinclair and Coulthard's model for interaction analysis is composed of 25 functional acts which are related in various syntactic ways at the discourse level. At the heart of classroom-based discourse is a structure which Sinclair and Coulthard (1975) and other researchers have shown is predominant in teacher-learner interaction: Initiation-Response-Feedback (I-R-F). Various possibilities exist at the act level within this basic structure. The data presented in Table 3 attempt to show that for negotiation of meaning to characterize interaction students have to be involved in discourse which embraces other structures than that of Initiation-Response-Feedback. Comparative data is provided from two texts discussed in Sinclair and Coulthard (1975).

Question 3: Availability of Input

Table 4 presents a synthesis of the data relating to research question 3: the extent to which linguistic input is made available to all participants in multi-site, technology-mediated L2 instruction. The data are shown in terms of frequencies and percentage proportions of different acts which are not available to students at either origination or remote sites, and also in terms of the origin of the acts (teacher or facilitator). With respect to the fiber-optic class observed, data was obtained at both sites, and may be considered to be composed of interaction which is intentionally conducted between both sites, as well as of some interaction which was conducted to the exclusion of the other site. For the microwave class observed, data were collected only at the origination site and not at any of the three remote sites. Figures indicated in Table 4 for phase one of the study concern unavailability of linguistic input only for the remote site, while for phase two of the study they concern unavailability at both sites.

Discussion

General Characteristics of Interaction

Results indicate that teacher acts dominate student acts by a proportion of 64% to 36% and 65.68% to 30.23% in the observed microwave and fiber-optic classes respectively. These results provide a superficial indication that interaction in the multi-site environment is comparable to that of the single-site environment (see evidence for L1 instruction from Bellack et al, 1966, and Dunkin & Biddle, 1974, that teachers typically do about two-thirds of the talking). It may be concluded from these results that a multi-site, technology-driven medium does not necessarily force teachers into a teacher-focused mode of instruction, as some critics of 'distance education' have assumed. With respect to student involvement in the remaining 30% of interaction, results indicate that remote-site students in the fiber-optic networked class are engaged in interaction to a greater extent than remote-site students in the microwave class. This may be accounted for in various ways, and not necessarily as a product of a difference in media. First, the activity that predominated the fiber-optic class involved students in systematically responding to teacher questions. Interaction was thus shared through the structural efforts of the teacher. The activities established by the microwave class teacher more frequently involved unsystematically requested responses. The remote-site was only brought into the interaction when the teacher became aware that students there had not participated for some time. A second influence on these results may have been the fact that the fiber-optic teacher taught the class specifically to a sub-group at each of the two sites, each composed of two students; there was, thus, a more equitable distribution of participants for interaction. In the microwave class, participant distribution was significantly unequal, with 14 students located at the origination-site and six at the three remote-sites. Nevertheless, there clearly is a need to give careful consideration to activity design and management in order to engage remote-site students in an equitable manner.

Results regarding structural sequences of exchanges that characterized interaction in the observed multi-site environments do not provide any clear conclusions. The Initiation-Response-Feedback structure claimed as typical of classroom-based interaction does not appear to predominate in the two classes observed in this research study. The fiber-optic class consisted of a somewhat lengthy introduction composed of teacher informatives (a category of Initiation) - this is reflected in the results which indicate a 20% use of Initiation exchanges without Response and Feedback moves. Further examination of this aspect of the data is required to reveal a more detailed picture of the exchange structures found and the participants involved in them.

Teacher use of Russian compared to English reveals a comparable picture in both environments with frequency of use of the L2 exceeding that of the L1 by approximately 15%, proportionately 55% - 40%. Student use of L2 and L1 reveals greater disparity across the two media, with the fiber-optic class typified by 15% of total student acts in Russian and 46% in English. Student use of the L1 and L2 in the microwave class was approximately equal at 38% of all student acts. Remaining acts were either non-verbal or inaudible in nature. Little evidence exists in the research literature of comparative uses of L1 and L2 in classroom instruction by which the present figures may be judged. They may, however, be understood in light of the fact that Russian has a tendency to be taught within more conventional methodological approaches in which teacher-focused instruction in L1 predominates. This said, there are clear signs indicated by a moderate T level of use of Russian (M = 53.98%) that some of the conditions for L2 interaction are in place.

Question 1: Contextual Features of Interaction

Multi-site instruction is characterized by its use of audio and video technology to mediate verbal and non-verbal interaction. Even between origination-site students and the local teacher interaction is technologically mediated in ways which it is not in the single-site environment. Students should always communicate through microphones, whether the message is directed essentially at the teacher, at the remote-site students, or at a local companion. In addition much of the work carried out by the teacher with text and graphic materials is displayed on TV monitors for both origination and remote-site students to see. The camera is an important transmitter of non-verbal and other contextual information in the L2 multi-site environment.

In the case of the microwave class observed in this study, two cameras were used to provide visual context for interaction: a teacher focused camera providing the context of teacher behavior, which may also occasionally be focused on student group work at the origination site, and an overhead camera used to focus on teacher manipulated materials (seven non-illustrated written texts were used in this class). There was no return video signal from the three remote sites to the origination site.

Fiber-optic networked instruction provides a richer and more varied video signal. In the class observed in this study three cameras were located at the origination site providing the visual context of teacher behavior, class behavior, and the use of teacher materials (six non-illustrated texts were used in this class). The number of cameras found at remote sites may vary. At the remote site observed in the present study, three cameras provided return signals of class behavior, front of room behavior, and overhead focus on materials, although only the first of these cameras was actually used during this class.

Results indicate that approximately 25% of all acts in both the microwave (24.80%) and the fiber-optic class (24.09%) were accompanied by non-verbal behavior that was mediated by video technology. Much of this non-verbal behavior, unsurprisingly, was found in support of teacher participation in interaction. Such a relatively significant figure suggests that non-verbal information is an important ingredient in classroom-based interaction and should be exploited especially in L2 instruction. It remains a possibility that technology-enhanced, non-verbal contextualization of linguistic input in the L2 classroom may be an effective way of focusing on clues for the learner that are vital in the L2 coding and decoding process. Such clues may not be as readily available to students in single-site instruction where interaction is not mediated by technology. Clearly the fiber-optic network providing two-way video signals is a more complete and therefore more useful transmitter of non-verbal information than the one-way video microwave system. Acts which were transmitted exclusively as non-linguistic information were relatively infrequent in the data obtained in this research study. Results regarding camera use within the fiber-optic system suggest that the teacher was able to exploit the technology to mediate interaction whenever it was required. 72.18% of all student acts in both sites were transmitted via the class-focused cameras, implying that complete video and audio signals were available for the same number of acts. Remote-site student acts were mediated 81.82% of the time while origination-site student acts were mediated 65.38% of the time. Sixty percent of all teacher acts were mediated in the same way. These figures provide a mean level of approximately 70% of fiber-optic-mediated acts where a participant in interaction was focused upon. By comparison the one-way video microwave system was unable to provide video contextualization of any remote-site participation in interaction, and only provided origination-site student participation when the teacher-camera was physically turned round to focus on student group work. Results also indicate a moderate level of use of overhead camera projected video of texts, occupying 53.83% of all microwave acts and 38.86% of all fiber-optic acts.

Question 2: Negotiation of Meaning

Evidence for student behavior beyond the predictable classroom role of responder to teacher Initiation moves was sought through an examination of student use of acts which are more typical of negotiated interaction. In terms of the Sinclair and Coulthard model of discourse analysis, negotiated interaction would involve participants in Initiation moves (informatives, elicitations, and directives), requests for repetition (loops), as well as some of the acts which indicate embellishment of a message (comments and starters), or boundaries between moves (markers). Both microwave and fiber-optic student behavior offer reasonably similar patterns of interaction. Predominant are the Response moves (replies, reactions, acknowledgments) of students in both environments (61.9% and 42.11% in the microwave and fiber-optic classes respectively). These figures, however, compare favorably with those provided by an analysis of L1 classroom interaction in two single-site classes discussed by Sinclair and Coulthard (1975) in which student responses were estimated to be in excess of 80% as a percentage of total student acts. The microwave and fiber-optic classes observed in this study also suggested that student Initiation moves, especially elicitation acts, were not uncommon, representing 14.92% of all student fiber-optic acts and 29.32% of all student microwave acts. These figures compare with 3.39% and 3.75% at each of the single-site classrooms discussed by Sinclair and Coulthard. The significantly higher occurrence of student Initiation moves in the microwave class are clearly a product of the fact that the teacher employed three unprepared, role-playing activities involving student-student negotiation of meaning. These role-playing activities were conducted exclusively in Russian, and led to short 'de-briefing' sessions at the end of each in which the teacher provided feedback to the whole class. Evidence is provided here for the positive effect of adequate activity design and management on successful interaction.

Question 3: Availability of input

Question 3 assesses the extent to which input--the complete linguistic and non-linguistic signal --is made available to all participants in interaction. Of particular importance in this regard is the assumption that unavailable acts, typically for the remote-site students but also for the origination-site students, may seriously interfere with successful participation in interaction. The unavailability of student replies, for example, as input, renders subsequent feedback potentially useless, as may occur with any move or act within the discourse process. Given the somewhat passive social nature of the role of the student in traditional instruction, it is unlikely that the unavailability of acts, i.e., the breakdown of interaction, will provoke frequent requests for discourse repair. It is, therefore, incumbent upon the teacher to ensure that breakdowns in interaction do not occur, to predict conditions when it is likely to happen, and to employ adequate strategies to counteract the typically passive social nature of the role of the student. Results obtained in the present study indicate that for the fiber-optic class 19.77% of all acts were unavailable to students, either at the remote-site or the origination-site. This would appear to be a significant level of discourse deterioration although further examination of the precise nature of the unavailable acts is required. For origination-site students 50.91% of all remote-site acts were made Unavailable, again a superficially high figure. This figure may be indicative perhaps of the fact that verbal interaction in the remote-site, typically consisting of comments on the ongoing instruction, is intentionally made for remote-site consumption only, even with the presence of a facilitator whose role may include control of non-instructionally related interaction. Part of the ethos of student behavior in multi-site instruction appears to be that interaction should only be made available to the whole class when it has been provoked by the teacher. This is quite clearly a by-product of a microphone-mediated instructional environment, one which needs careful evaluation for L2 instruction and the successful achievement of interaction. By comparison, 13.41% of all acts were made unavailable to remote-site students. Teacher acts which were unavailable to remote-site students reached a level of 5.88% of all teacher acts. Comparative results for the microwave class are somewhat narrower in scope since data were not obtained on interaction at the remote-sites. Levels of unavailability of acts to remote-site students from the origination-site were comparable to those in the fiber-optic environment--14.06% of all acts, and 1.61% of all teacher acts.

With respect to the availability of specific types of acts, the following may be highlighted: 15.71% of all fiber-optic Initiation acts (informatives, elicits, and directives) unavailable to students in either remote or origination sites; and the unavailability of 20.21% of fiber-optic and 28.32% of microwave Response acts (replies, reactions, and acknowledgments), probably caused by students not depressing microphone buttons when responding.

Conclusions

This research study has essentially proposed a format for the analysis and description of interaction in multi-site, technology-mediated L2 instruction, in the light of recent developments made in the scope of distance education technology provided through fiber-optic networking. As a basis for such analysis and description, it has used the discourse analytical model of Sinclair and Coulthard, together with additional parameters intended to capture technology and situation-related aspects of the instructional environments under observation. Given the lack of research tradition in the field of multi-site, L2 instruction, the present study has necessarily been qualitative and descriptive in nature. Results obtained should be understood purely as a reflection of the specific environments from which they were derived, and as indications of trends and patterns of behavior that may be worthwhile pursuing. Use of the Sinclair and Coulthard instrument in the present study suggests that it may be an adequate tool for capturing the nature of technology-mediated classroom instruction and that its underlying systematic grammar provides an opportunity for the operational definition of interaction in terms of transactions, exchanges, moves, and acts. It should be stressed that ample investment in training suitably qualified raters must be made.

Warriner-Burke (1990), Arendt and Warriner-Burke (1990), and Davis (1988) have suggested that distance education environments impose limitations on the nature of interaction that may be generated across sites. Such limitations may imply a sacrifice in L2 proficiency standards which have been established with considerable effort over the last twenty-five years. However, criticisms of distance education which reduce media on the one hand and interaction on the other to single variable phenomena in a cause-effect relationship at best remain untested assumptions in need of research, and at worst gross simplifications of what essentially must be considered as highly complex multi-variable behaviors.

With respect to results obtained in the present research study, several avenues for further investigation come to light, including the effects of two-way video versus one-way video on the degree and quality of involvement of remote-site students, and the effects of video-enhanced, non-linguistic contextualization of linguistic input for all students, as well as work which may help to provide a more complete picture of the nature of interaction in multi-site, technology-mediated L2 instruction. Overall, the picture obtained from the present study suggests that successful interaction is more a product of the skill, patience, experience, confidence, and imagination of the teacher than it is of technology-imposed conditions.

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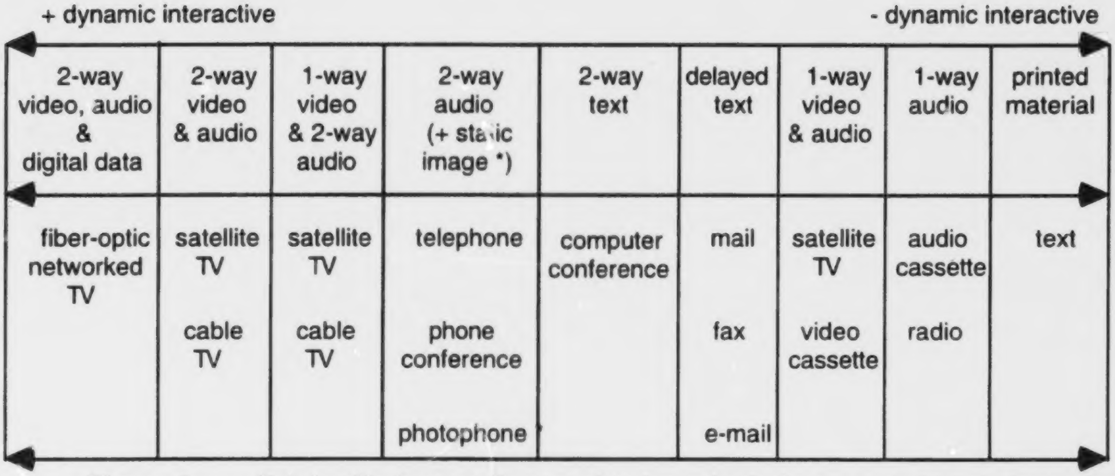

+ dynamic interactive								- dynamic interactive
2-way video, audio & digital data	2-way video & audio	1-way video & 2-way audio	2-way audio (+ static image *)	2-way text	delayed text	1-way video & audio	1-way audio	printed material
fiber-optic networked TV	satellite TV cable TV	satellite TV cable TV	telephone phone conference photophone *	computer conference	mail fax e-mail	satellite TV video cassette	audio cassette radio	text

Figure 1. Relationship between distance education technologies on a +/- dynamic interactive continuum

Table 1. General characteristics of interaction.

	Frequencies		Percentages of total	
	PHASE 1	PHASE 2	PHASE 1	PHASE 2
Length of class/mins.	40	30		
Acts	875	440		
Moves	569	289		
Exchanges	270	165		
Transactions	78			
Av. acts/move	1.54	1.52		
Av. moves/exchange	2.11	1.75		
Av. acts/exchange	3.24	2.67		
T acts	560	289	64.00	65.68
S acts	315	133	36.00	30.23
F acts		18		4.09
Remote S acts	48	55	15.24	41.35
Origination S acts	222	78	70.48	58.65
Class acts	28		8.89	
I-R-F exchanges	85	23	31.48	13.94
I-R exchanges	66	33	24.44	20.00
I exchanges	31	32	11.48	19.39
(FR)(FO) exchanges	56	42	20.74	25.45
T acts/Russian	312	151	55.71	52.25
T acts/English	224	118	40.00	40.83
S acts/Russian	120	20	38.10	15.04
S acts/English	122	61	38.73	45.86

Note: T = teacher; S = student; F = facilitator
I-R-F = Initiation-Response-Feedback/I-R = Initiation-Response
(FR)(FO) = Optional Frame and optional Focus moves

Table 2. Context of interaction.

	Frequencies		Percentages of total	
	PHASE 1	PHASE 2	PHASE 1	PHASE 2
Acts supported by visual information	217	106	24.80	24.09
T non-linguistic acts	16	1	2.86	0.35
S non-linguistic acts	10	15	3.17	11.28
T camera	386	173	68.93	59.86
S camera	18	96	5.71	72.18
Origination site S camera		51		65.38
Remote site S camera		45		81.82
OHP camera (texts)	471	171	53.83	38.86

Note: T = teacher; S = student; OHP = Overhead projection

Table 3. Negotiation of meaning in interaction.

	Frequencies				Percentages of total			
Student	PHASE 1	PHASE 2	S&C 1	S&C 2	PHASE 1	PHASE 2	S&C 1	S&C 2
Elicits	39	26	0	4	12.38	19.55	0.00	2.50
Directives	2	5	0	0	0.63	3.76	0.00	0.00
Informatives	1	0	4	2	0.32	0.00	3.39	1.25
Metastatements	1	8	0	0	0.32	6.02	0.00	0.00
Checks	2	0	0	0	0.63	0.00	0.00	0.00
Loops	2	0	0	0	0.63	0.00	0.00	0.00
Head acts	47	39	4	6	14.92	29.32	3.39	3.75
Comments	9	4	0	0	2.86	3.01	0.00	0.00
Asides	13	4	0	0	4.13	3.01	0.00	0.00
Replies/Reacts/ Acknow's/Lists	195	56	95	138	61.90	42.11	80.51	86.25
Starters	2	3	0	1	0.63	2.26	0	0.63
Markers	7	2	0	0	2.22	1.50	0	0.00

Note: S&C = Sinclair & Coulthard; figures in these columns were derived from the data for each of 2 studies presented in Sinclair & Coulthard (1975)

Table 4. Unavailability of input in interaction.

Act	Frequencies		Percentages of total	
	PHASE 1	PHASE 2	PHASE 1	PHASE 2
Total acts unavailable		87		19.77
Acts unavailable to origination site		28		50.91
Acts unavailable to remote site	123	59	14.06	13.41
T acts unavailable to remote site	9	17	1.61	5.88
F acts unavailable to origination site		2		11.11
Elicits	11	12	7.33	16.67
Directives	0	6	0.00	37.5
Metastatements	0	4	0.00	11.11
Checks	3	0	16.67	0.00
Head acts	14	22	6.83	15.71
Comments	4	1	6.56	6.67
Asides	10	4	38.46	57.14
Replies/Reacts/Lists/ Acknowledges	64	19	28.32	20.21
Clues	1	0	11.11	0.00
Accepts	3	2	6.12	7.41
Prompts	1	0	5.56	0.00
Bid	1	0	50.00	0.00
Nominations	2	3	0.91	8.57
Inaudible acts	23	36	2.63	8.18

Note: T = teacher; F = facilitator

Do Music Teachers Feel That the Iowa Communications Network is a Valid Platform For the Delivery of Music Instruction?
and
Where are music teachers in the innovation-decision making process?

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Results

The ATTM was mailed to 200 Iowa music teachers in early May, 1994. Completed ATTMs were obtained from 122 teachers. Four ATTMs were not used in the study because more than 50 percent of the questions were not answered. Each participant is currently, or has very recently, been a music teacher in Iowa. Each participant either returned an ATTM that was mailed to them in May or June, or answered the research questions over the telephone. The data gathered from music teacher responses were used in the statistical analysis of this study. Tables A and B explain ATTM scoring.

The following results were computed by finding the mean, standard deviation, and range of the standard deviation of total ATTM scores divided into groups according to teacher attributes.

The majority of teachers indicated by their responses that they were undecided about teaching music over the ICN. When the standard deviation range was investigated for both male and female teachers, it was found that more female than male teachers have made a decision either for or against using the ICN to deliver music instruction. The standard deviation range of male teachers stayed within the undecided category while the lower end of the female standard range was made up of teachers who disagreed with the concept of teaching music over the ICN and the upper end of the female teacher's standard deviation range was made up of teachers who agreed with the concept.

Teachers who are of the following ages, 20-29, 50-59, and 60-69 tended to be the most positive concerning using the ICN to deliver music instruction. The 60-69 age group scored the highest or felt most positive, of all age groups in this matter. Teachers who fell into the 30-39 and 40-49 age groups indicated that they have not made up their minds.

When the ATTM data was analyzed according to the teacher's area of instruction, the vocal teachers tended to have a slightly more negative view concerning using the ICN to deliver music instruction. The administrative/other area of instruction leaned more toward having a positive attitude toward ICN use for music instruction. All instrumental music teachers were undecided in this matter.

When data was analyzed according to age group taught, elementary and high school teachers indicated that they have not made up their minds about teaching music over the ICN. Middle school teachers were the most positive toward using the ICN to deliver music instruction.

Teachers who hold a master's degree were more positive toward using the ICN to deliver music instruction than teachers who indicated that the baccalaureate and specialist degrees were their highest degrees.

Teachers who have been in teaching and administration 31-40 years tended to have a more positive attitude toward teaching music over the ICN than teachers who have taught 1-30 years.

Teachers who teach in schools which have an approximate daily attendance of 0-3000 students tend to have a more positive attitude toward teaching music over the ICN than teachers who teach in districts with larger populations. The schools with the smallest number of music teachers also had the highest average ATTM scores.

When the data was analyzed according to community population the following results were found. As the community population increased so did music teacher acceptance of using the ICN to deliver music courses. The results of the analysis by community population tends to run contrary to results according to daily school attendance and number of music instructors in the district, assuming that the districts with the highest daily attendance and highest number of music teachers also have the highest community populations. The researcher suspects that teachers were more accurate in listing the population of their school district and the number of music teachers in their district than in stating the population of their communities. The teachers who responded to the ATTM over the telephone seemed to be unsure about answering the question concerning community population.

The mean ATTM scores of teachers who indicated that they have a district music administrator compared to those who said they did not, were within .10. However, the range of the teacher's ATTM scores who do have a district music administrator was larger and was more negative toward using the ICN to deliver instruction.

Teachers tend to feel more positive toward using the ICN to deliver music instruction as they have had more experience with distance education technologies. The teachers who teach in schools that are connected or will be connected to the ICN were more positive toward using the ICN to deliver music instruction than teachers who were not connected or those who did not know if they were connected The teachers who did not know if their school or school district had a connection to the ICN had the most negative attitude toward teaching music over the ICN.

Analysis of Data According to the First Three Stages of the Innovation/ Decision-Making Process

Rogers, in his book, Diffusion of Innovations, states that there are five sequential stages in the process of innovation/decision-making. These stages are:

1. *Knowledge* occurs when an individual (or other decision-making unit) is exposed to the innovation's existence and gains some understanding of how it functions.
2. *Persuasion* occurs when an individual (or other decision-making unit) forms a favorable or unfavorable attitude toward the innovation.
3. *Decision* occurs when an individual (or other decision-making unit) engages in activities that lead to a choice to adopt or reject the innovation.
4. *Implementation* occurs when an individual (or other decision-making unit) puts an innovation into use.
5. *Confirmation* occurs when an individual (or other decision-making unit) seeks reinforcement of an innovation-decision already made, but he or she may reverse this previous decision if exposed to conflicting messages about the innovations.

I have attempted to find out where music teachers are in the first three stages concerning using the ICN to deliver music instruction.

The 122 teachers who answered questions indicating knowledge of the ICN had a mean ATTM score of 2.7 on a scale of one to five. Their standard deviation range extended from 1.4 to 4 indicating that teachers varied greatly in their level of knowledge of the ICN.

The 122 teachers who answered questions indicating where they are in the persuasion stage of adoption of the ICN had a mean ATTM score of 3.9. Their standard deviation range extended from 3 to 4.7 indicating that many teachers have formed a favorable attitude toward accepting the ICN as a valid platform for music education.

The 94 teachers who answered questions indicating where they are in the decision process had a mean ATTM score of 3. Their standard deviation range extended from 2 to 3.9, indicating that some of these teachers have chosen not to engage in activities that lead to a choice to adopt or reject the ICN. Most of these teachers have not made a choice concerning the adoption or rejection of the ICN. Since the top of the standard deviation range was within one-tenth of a point away from acceptance of choosing to engage in activities that lead to a choice, it is reasonable to believe that several teachers have taken that step.

Analysis According to Subject Area

Teachers are most favorable toward using the ICN to:

- deliver music classes to small districts, and
- deliver courses to music educators either as continuing education classes or graduate classes applying to masters and doctorate degrees.

Teachers are least favorable toward using the ICN to:

- audition high school musicians for state performance groups,
- deliver middle school music instruction, and
- deliver master classes to vocal and instrumental music students for college credit.

Teachers are undecided about the following music areas, but their scores lean more toward acceptance of using the ICN to deliver music instruction.

- music classes for high school credit,
- music classes that fill a void in music education,
- instruction in music history and theory, and
- jazz instruction

Selected Comments

The following comments are representative of all ideas expressed

Use of distant site monitor

- needs to be a paid staff person trained in the area being taught at distance site.
- If there were a trained person at the distance site wouldn't that area already be taught?
- With full teacher work loads who will supervise the distance site?

Music teacher jobs (cutbacks-major concern)

- Could put ourselves out of business if we offer classes over ICN that we already teach.
- The teacher cannot simulate personal touch and interpersonal communication over the ICN.
- Would like to see classes in music theory and history and master classes offered as long as they do not replace teachers.
- The ICN should be for program enhancement, not program replacement. It is not a way to eliminate staff, but a way to enhance curriculum.

Teachers Need to Experience the ICN

- I do not know very much about the ICN but would like to learn more.
- I would have to see the program (the ICN in use) to have an opinion about its effectiveness.
- I am unaware of the sound capabilities of the ICN.
- I am into the technology of teaching music. I just do not know the plans for ICN and music and its capabilities for interactive teaching. I would love more information.
- It seems to me that the ICN would be beneficial to schools of all sizes.
- I would like to have more information about the ICN and how to get it in our school system.

Positive Feelings Concerning Teaching Music Over the ICN

- I definitely feel the ICN would greatly improve a small school's music program!
- The ICN should be used to supplement the current music program in any school district. The schools I see it helping most are small schools whose faculty is already spread quite thin.
- I believe one of the best possibilities for this technology is the teaching of classes that are not available to many students in smaller and even some large districts. I also see it as a potential tool for All-state auditions or some competitions, but the quality of sound would be a very important component of anything of that nature.
- My concern with ICN is that we never substitute real human contact between students and teachers. I can see this could be used in an effective way to enhance classroom instruction - but hopefully, never replace it.
- I feel there are infinite opportunities available to music educators through the ICN. I think the largest drawback currently is lack of education. I also feel strongly that it (The ICN) should be for program enhancement, not program replacement. It is not a way to eliminate staff, but a way to increase student curriculum.
- The ICN is a wonderful tool at bringing in outside master musicians to our students!! As a school that has an ICN studio and I as an instructor who has participated in producing an on site presentation, our biggest problem was contacting an audience. There was no information on the other sites such as interested music programs that had used sites before, what schools had access, who signed up for the All-State production. Our target audience is already defined! How do we contact them?
- Only for college credit or enrichment purposes.
- I feel the ICN can and will be of great benefit by opening avenues of information to students that are not presently known by their institutions.
- Tremendous potential for enhancement.
- Most effective way of using the ICN - not traditional
- The ICN may keep music faculty from burnout.
- While my school district is not hooked into ICN I would use it for theory and history if we were. I plan to use the ICN hookup at

the local community college for graduate classes and would consider having my student use it there.

Problems Teaching Music Over the ICN

- The personal touch and interpersonal communication that an in-room teacher can provide cannot be simulated or replaced by a teacher via camera.
- My concern with ICN is that we never substitute real human contact between students and teachers.
- Some of these class ideas depend on who is teaching the course. College teachers? H.S. teachers? It will depend.
- Concern about scheduling esp. classes for credit. Unsure if ICN could hold attention of junior high students.
- I do not feel large classes can be taught in this manner because of the changing attitudes of some students. Discipline problems have increased severely since I was in high school and I feel there needs to be a person trained in that area right there in the classroom.
- Our high school students have had an opportunity to talk German over ICN. Discipline and motivation is the main problem with classes that have no certified teacher in the classroom. Teachers at our high school have adamantly recommended that these classes stop due to their ineffectiveness.
- Some music courses will be a great addition to the music curriculum, some, (like jazz improvisation and swing choir choreography) are too difficult to teach to slower learning individuals.
- They will "tune you out". They need a "live" teacher.
- Students don't always have time in their day to schedule extra classes.
- I strongly disagree with the presumption that because a district is small the education is inferior! Some of the strongest jazz programs are in small districts!!

Reference

Rogers, E.M. (1983). Diffusion of innovations. New York: The Free Press.

Tables

Table 4.1

ATTM Averages For All Teachers

# of Questions Used	$\overline{X}$	SD	Range	Highest Average Possible	Lowest Average Possible	Data Taken from (n) Number of Answers
16	3.4	.4	3-3.8	5	1	122

Table 4.2

ATTM Score Analysis Table
(Level of Positive & Negative Feelings Toward Teaching Music Over the ICN)

Very Negative	Negative	Undecided	Positive	Very Positive
1	2	3	4	5

Investigating Teacher Change Associated with Distance Learning in Education

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Summary

The focus of this study was to determine how the support structure (i.e., Literacy Institute/ Technology Workshops, Regional Coordinator, local school district faculty/administration) affected distance education activities of literacy teachers in the state of Iowa. The specific purposes were: 1) to determine Stages of Concern and Levels of Use of participating teachers, 2) to determine if specific elements within the support structure affected distance education activities, and 3) to identify needs within the support structure to enhance distance education activities. Two dimensions of the Concerns-Based Adoption Model (CBAM) were used along with individual interviews. Data were triangulated by means of documents, questionnaires, and interviews. The thirty teachers who participated in a five-day, 1993 Teacher Education Alliance Literacy Institute were asked to complete a 35-item Stages of Concern Questionnaire (SoCQ) Four of these teachers were invited to participate in the study. Members of the study group were asked to submit a biweekly log for seven months in which they recorded encounters with distance education (e.g. conversations, articles read, lessons prepared and taught, lessons facilitated etc.). At the end of the seven months, two of the four teachers were individually interviewed about their distance education activities and the effect of the support structure in implementing distance education activities.

Significance and Need

Even though advances in telecommunication technologies have created increasing K-12 interest in distance education, the rate of adoption is quite slow (McNeil, 1990; Gunawardena, 1990; Heinich, 1984). The dominant focus of distance education research has been on learner outcomes, learner characteristics, and learner attitudes. As scholars have attempted to formulate a theoretical base for distance education and to compare distance education to conventional education (Holmberg, 1986; Keegan, 1988; Perraton, 1988; Shale, 1988; Peters, 1988; Cropley and Kahl, 1983) researchers have studied student characteristics and course development (Holmberg, 1986; Kaye and Rumble, 1981; Sewart, 1988). Even though the literature in distance education discusses the importance of faculty, this group has been largely neglected by the research (Beaudoin 1990).

The research of distance education has given scant attention to classroom teacher growth and development within the framework of distance education, yet studies suggest that faculty attitude toward instructional technology is a primary barrier to the continued growth of distance education programs (Stinehart, 1988; Gunawardena, 1990; McNeil, 1990). Shale (1988) maintains that the conditions necessary for the educational process in distance education are the same as those necessary in face-to-face contact. The task of distance educator is to find ways to ensure these necessary conditions. Others see a modified role for the distance educator.

Beaudoin (1990) explains that distance education revolves around a learner-centered system with the teacher in a facilitating role. That is, the teacher must attend closely to learning process and augment study materials with explanations, references, and reinforcements for the students. Teachers accustomed to more conventional teaching modes will have to acquire additional skills. They will need to assume expanded roles, not only teaching distance learners, but also organizing learning for independent study.

Various studies, in fact, suggest that successful distance teaching requires use of a different set of skills than those used in traditional teaching (Hackman and Walker, 1990; Strain 1987; Maloy and Perry, 1991; Burge and Howard, 1991), yet faculty training programs often concentrate primarily on the operation of technology rather than on how to teach at a distance (Dillon, Hengst, and Zoller, 1991; Cyrs, 1989).

A survey study of Ohio University faculty who had taught at least one interactive television course (Gehlauf, Schatz and Frye, 1991) compared teaching behaviors in the interactive television courses with the instructors' ideas about effective teaching practices. Results revealed that instructors wanted to cling to more traditional approaches even though they believed audio-visual methods were more effective. The participants in the study stressed the importance of organization for interactive television courses as well as the importance of "hands-on" experience and role playing exercises as a part of their training as distance teachers.

Many agree that distance learning in education is an innovation which constitutes a considerable change for classroom teachers. The literature suggests that the ingredient most neglected in the diffusion of distance education is leadership to support change. In contrast, the ingredient most prominent is training. However, training will be successful only if it exists in an environment supportive of change.

For many years researchers have studied how educational institutions adopt, implement, and ultimately institutionalize educational innovations. (Fuller, 1969; Hall, Wallace, and Dossett, 1973; Hall, Loucks, Rutherford, and Newlove, 1975). Lindquist (1978) indicated that successful change in education depends on at least the following five components:

- ownership by those affected;
- access to both information and interpersonal resources;
- leadership that is guiding, involving and initiating rather than authoritarian, influential, and dogmatic;
- an open environment that seeks out and listens to various opinions;
- rewards that foster self esteem and personal development.

Fullan (1985) offered six key factors concerning educational change:

1. Change is a process happening over time.

2. Anxiety and uncertainty are common in initial stages of change.

3. Assistance is needed. Guskey (1986) reported that new practices significant amount of change succeed or die by the amount of assistance teachers receive (reassurance, support, expansion of users' repertoires, problem solving, helping users to master the practice, and increased interdependence). Perhaps forceful leadership is the factor that contributes most directly to effective changes in classroom practice that become part of everyday routines.

4. Change occurs through practice and feedback.

5. Teachers need to understand the rationale and reason for implementing the change. Despite assistance and practice, experienced teachers seldom become committed to an innovation until they have seen that the new practices work well in their classrooms with their students (Guskey, 1986).

6. Successful change occurs through interaction with peers and administration.

Study Description

The purpose of this study was to determine how the support structure (the Literacy Institute/Technology Workshops, regional coordinator, local district faculty/administration) of the Teacher Education Alliance affected the utilization of fiber optic distance education by classroom teachers of English & Language Arts. The objectives were: 1) to determine Stages of Concern and Levels of Use of participating teachers, 2) to determine if specific elements within the support structure enhanced distance education activity, and 3) to identify needs within the support structure to strengthen the utilization of distance education.

Methodology

Thirty K-12 teachers of reading/language arts from across the state were invited by their Regional Coordinator for the Star Schools project to participate in a 5-day, 1993 summer Literacy Institute (See Table 1). The goals of the Institute were to discuss literacy issues and to explore the impact and potential of distance education on literacy instruction. A 3-day Technology Workshop was available in each region for Institute participants. The purpose of the Technology Workshop was to introduce teachers to distance education technology and general teaching practices of distance education.

In the fall of 1993 these 30 teachers were asked to complete a 35-item Stages of Concern Questionnaire (SoCQ) and to indicate their willingness to participate in the study. Analysis of the SoCQ profiles indicated that two high stages of concern were present, Stage 0 and Stage 5. From the twenty-eight respondents, four teachers with a peak in the concerns profile at either Stage 0 or Stage 5 were invited to serve as study group members. For seven months, each study group member was asked to submit a biweekly teaching log in which he/she recorded encounters with distance education (e.g.

conversations, articles read, lessons prepared and taught, lessons facilitated etc.) At the end of the seven months, two study group members were individually interviewed about distance education activities during the past year and the effect of the support structure in implementing distance education activities.

Instrumentation

Researchers at the University of Texas at Austin developed the Concerns-Base Adoption Model (CBAM) as a means to learn more about change in the school improvement process (Hord et al, 1987). Two dimensions of the Concerns-Based Adoption Model (CBAM) were in the data gathering.

The Stages of Concern (SoC) dimension of CBAM is a way of identifying concerns that users, or potential users, have about an innovation. The seven stages are grouped into three dimensions---SELF, TASK, and IMPACT. Stage 0 (Awareness), Stage 1 (Informational), and Stage 2 (Personal) are part of the SELF dimension. During the early stages of implementation teachers are likely to be at the stages of SELF. The TASK dimension includes State 3 (Management). Stage 4 (Consequence), Stage 5 (Collaboration), and Stage 6 (Refusing) are part of the IMPACT dimension (Hord et al., 1987; Loucks and Hall, 1977). Once the concerns begin to focus on the effects of the innovation on students and effectiveness of the implementation, the level of IMPACT has been reached. Table 2 includes representative statements for each level.

Each of the four study group members was asked to submit a biweekly log, October-May, in which she recorded encounters with distance education (e.g. conversations, articles read, lessons prepared and taught, lessons facilitated etc.) Log entries were analyzed according to major support structure elements (i.e., Literacy Institute/Technology Workshop, regional coordinator, local school district faculty/administration).

Levels of Use (LoU) interview is another tool of CBAM. This monitoring tool determines how the teacher is using the innovation and how comfortable and skilled the teacher is in getting the students to respond to an innovation. The Levels of Use provide a means of determining if the effort of the implementation of the innovation has been successful (Loucks and Melle, 1982). There are eight levels. The first three levels deal with nonusers: (1) LoU--Nonuse, (2) LoU I--Orientation, (3) LoU II--Preparation. The remaining levels are user levels: (4) LoU III--Mechanical Use, (5) LoU IVA--Routine, (6) LoU IVB--Refinement, (7) LoU--Integration, and (8) LoU VI--Renewal. Table 3 includes behavioral definitions for each level.

Table 1. 1993 Literacy Institute Participants

Variable	Number	Percent
Sex		
Male	5	17%
Female	25	83%
Race		
Caucasian	28	93%
Unknown	2	07%
Degree held		
Bachelor's	18	62%
Master's	11	38%
Teaching level		
Elementary	4	14%
Middle/High School	22	8%

Table 2. Stages of Concerns

SELF		
0	Awareness:	I am not concerned about the innovation.
1	Informational:	I would like to know more about the innovation.
2	Personal:	How will using the innovation affect me?
TASK		
3	Management:	I seem to be spending all my time getting ready.
IMPACT		
4	Consequences:	How is the innovation affecting my students?
5	Collaboration:	I am concerned about relating what I am doing with what other instructors are doing.
6	Refocusing:	I have ideas about something that would work even better.

Table 3. Levels of Use

Level of Use		Behavioral Definitions of Use
0.	Nonuse:	Has little or no knowledge of distance education and no involvement in the support structure.
I.	Orientation:	Has recently acquired information about distance education from the support structure.
II.	Preparation:	Prepares for the first time to become involved in using distance education with assistance from the support structure.
III.	Mechanical Use:	Focuses short term use of distance education with little reflection. Changes in use are made to meet user needs. User is engaged in a step-by-step attempt to use distance education with use of the support structure. Use may be disjointed/superficial.
IV.	Routine Use:	Shows stable use of distance education with few changes in the process. Little thought has been given to improving distance education through the assistance of the support structure or the consequences of using distance education.
V.	Refinement Use:	Varies the use of distance education through the assistance of the support structure to increase impact on students. Variations are based on knowledge of both long and short-term consequences on students.
VI.	Integration Use:	Combines own efforts to use distance education with activities of other colleagues to achieve a collective impact on students.
VII.	Renewal:	Reevaluates the quality of cooperative learning and support structure, seeks major modifications or alternatives to current reports to increase student impact, examines new developments, and sets new goals.

Contents of a semi-structured interview, approximately one hour in length, with two of the study group members were analyzed to determine the Levels of Use. The two teachers interviewed had submitted detailed monthly logs and were representative of the Literacy Institute members. They were female high school teachers with a bachelors degree working in a building with a distance education classroom. Each had completed both the Literacy Institute and the 3-day Technology Workshop. Interview contents were examined to explore the effect of the support structure and on the teacher's use of distance learning in education activities.

Data Analysis

Data were triangulated by means of documents, questionnaires, and interviews.

Stages of Concern Questionnaire

Individuals move through the stages of concern at a different pace. Typically, SELF concerns will be intense at the beginning of the innovation change process. TASK concerns develop next, followed by IMPACT.

Each of the seven stages was represented by five specific statements on a 35-item questionnaire. Twenty-eight questionnaires were returned. The questionnaires were hand scored, and each profile was plotted to determine individual's stage of concern. The raw score from the sum of the responses for each section of five statements on a scale of 0 to 7 were converted to percentile scores for interpretation according to Hall et al. (1986). Table 4 shows the individual stages of concern percentile scores for the twenty-eight Literacy Institute participants who returned the questionnaire. Thirteen (64% percent) of the teachers were at the SELF dimension (Stages 0, 1, or 2). None of the teachers were at the TASK dimension and ten (36%) of the teachers were at the IMPACT dimension (Stages 4, 5, or 6).

According to the indicators provided by the information from the Stages of Concern Questionnaire, a large percentage of the respondents (46%) were aware of and concerned about distance learning in education and were interested in learning more about the innovation (Stage 0). Many other respondents (36%) were concerned about the collaborative aspects of distance learning in education (Stage 5).

Logs

The four teachers in the study group were asked to submit biweekly logs for seven months in which they recorded encounters with distance education (e.g. conversations, articles read, lessons prepared and taught, lessons facilitated etc.). Reminders to submit logs were sent to each teacher at the beginning of the month. One of the four teachers submitted log entries via electronic mail. The other three teachers mailed log entries. Two of the four teachers submitted very detailed logs each month. The log entries were analyzed by organizing the contents according to major support structure elements (i.e., Literacy Institute /Technology Workshop, regional coordinator, local school district faculty/administration). Table 5 provides a composite of the data from the logs indicating teachers' perceptions as to the influence of the various components of the support structure on teachers' use of distance education activities.

The log entries indicate that the ICN classrooms were being used. A variety of student experiences took place, however none of the classroom activities described were initiated by Literacy Institute participants or received by them. Only one of the classroom activities described, the elementary students' interviews of Native Americans, might be considered "English/Language Arts related". Logs did praise the ICN advantage to rural Iowa as a means to save time in travel and to allow teachers to get professional help. However, there appeared to be little ICN activity related to inservice or professional networking. No reference was made concerning the school administrators' role in encouraging or supporting ICN classroom activities.

It is interesting that none of the teachers' logs mentioned communications from Teacher Education Alliance personnel. Each Literacy Institute participant would have received the Teacher Education Alliance newsletter, the TEA Times. Nineteen issues have been published. In addition the Literacy Institute participants were sent three communications from the TEA Literacy consultants responding to ongoing Institute concerns: censorship, assessment, and standards. They were also informed on whom to contact concerning procedures for initiating school electronic mail hook-up. In addition, there was scant mention of any contact with or communication from the regional star school coordinator.

Table 4. Individual Stages of Concern Percentile Scores

Teacher	Stage 0	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
1	**91**	69	55	30	11	36	22
2	86	84	91	83	30	**98**	26
3	60	60	83	43	38	**98**	52
4	72	60	78	47	59	**88**	69
5	**96**	84	70	52	24	44	34
6	95	93	**96**	85	54	80	69
7	60	80	78	43	76	**88**	47
8	**95**	84	72	34	33	84	38
9	**96**	84	70	52	24	44	34
10	**91**	69	55	30	11	36	22
11	95	93	**96**	85	54	80	69
12	60	60	83	43	38	**98**	52
13	60	80	78	43	76	**88**	47
14	72	60	78	47	59	**88**	69
15	86	84	91	83	30	**98**	26
16	**95**	84	72	34	33	84	38
17	**91**	88	85	52	66	88	60
18	94	84	**95**	85	48	91	65
19	**98**	57	67	80	11	28	34
20	89	**96**	92	56	11	52	26
21	84	75	**96**	39	76	98	60
22	84	95	89	27	66	**97**	52
23	**93**	80	67	85	86	80	52
24	**99**	88	89	98	71	68	52
25	**95**	93	94	94	86	91	81
26	**94**	84	45	65	1	59	26
27	**98**	95	85	85	43	64	57
28	72	60	45	65	24	**80**	34

Stage 0	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**	**Stage 5**	**Stage 6**
Awareness	Informational	Personal	Management	Consequence	Collaboration	Refocusing
13	1	4	0	0	10	0
46%	3.5%	14.3%	0	0	35.7%	0

Table 5. Log References

Institute/Workshop

- local systems are superior to the systems used during the Institute & Workshop

Regional

- area sharing session for Literacy Institute participants
- area principals met via ICN to discuss ICN scheduling & administrative concerns

Local

- The faculty differ in their philosophy regarding distance education and other technology -- "We have believers and non believers."
- National Guard spent a day in the building using the ICN for training. Students were very aware of the presence of Guard members in the school.
- The community college is offering ICN evening courses.
- High school music students used ICN to work with college music professors in preparation for All State.
- Physics students linked via ICN with students from another district to discuss a wind power project.
- Elementary students used the ICN to interview Native Americans in another community.
- Student Councils from six area schools met via ICN to share ideas and goals for the school year.
- A high school Spanish class was a receive site for a program.
- The algebra class used the ICN room overhead camera for a demonstration of the TI 80 graphing calculator.
- The ICN was demonstrated to the Rotary and to the district Parent Advisory Committee.
- Whittle Channel One ran a special about the future of fiber optics networks. The program included Vice President Gore who said that all schools should be connected to "the Highway" by the year 2000.
- State and local newspaper articles have featured fiber optics. Of the ten newspaper articles summarized, six dealt with political/financial controversies; one focused on the creation of a bipartisan board to oversee the ICN; three dealt with the educational advantages of fiber optics.
- ISEA communication shared concerns that fiber optics communications network is primarily a delivery system for higher education offerings.
- A booklet listing university classes offered via ICN was in the teachers' lounge.
- "There is no distance education going on in my school."

Interviews: Levels of Use

Two of the study group members who regularly submitted detailed monthly logs were interviewed individually. Each of these teachers taught in buildings with a distance education classroom and had completed the three-day Technology Workshop. The interview transcript was used to determine individual teacher's Level of Use of distance education activities based on categories: (Loucks et al., 1975) and to determine the influence of the major support structure elements (i.e., Literacy Institute/Technology Workshop, regional coordinator, local school district faculty /administration).

Levels of Use

Table 6 indicates the Levels of Use of the study group teachers with regard to their Stage of Concern.

Table 6. Levels of Use

Teacher Stage of Concern	Level of Use
1 Awareness	Preparation
2 Collaboration	Preparation

Log Entries Summary

Based on the interview responses, teachers had little difficulty separating the three components of the support structure. Each of the three components had some influence on teachers' implementation of distance education activities, but provided varying degrees of support for the teachers in the implementation process. The following summary provides a composite of the data from the interviews indicating teachers' perceptions concerning the three components of the support structure for teachers in distance education and the influence of the three components on teachers' use of distance education activities: Literacy Institute/ Technology Workshop, Regional Coordinator, and Local Administration/Faculty.

Teacher One

Teacher One teaches high school English/Language Arts in a small, rural, Iowa community with approximately 250 students in grades 10-12. During 1993-1994, this teacher taught eight different classes in addition to being the assistant drama director and helping with the all-school spring play.

Teacher One indicated that in her opinion, the real strengths of using the ICN and distance education activities were that the students and teachers are able to use resources beyond those available in a small town. With limited resources, ICN should make it possible to access all kinds of materials. Being part of the distance education project made her aware of additional materials and resources available to teachers.

In her opinion, the problem with using the ICN and distance education activities was that the communication had been very poor. It had been extremely difficult to "get through" all the procedures to use the ICN system. In addition, it was difficult to know what is on the system. There was not communication to know what might be available in which teachers could participate or become part of.

Institute/Workshop

This teacher felt that participation in the Literacy Institute and the Technology Workshop exposed her to excellent material and to enthusiasm for "the system." The people involved, the experts which were part of the Institute and the Workshop, and the wonderful variety of material contributed to this enthusiasm.

She felt that the purposes of the Literacy Institute were to share with teachers new directions in literacy, to allow teachers to share their own successes, to help others find success, and to experience the use of the ICN network for literacy endeavors..

> "The biggest benefit of the institute for me was being exposed to all of this new and innovative materials available. It was a shot in the arm. The Literacy Institute was full of ideas, and those ideas are now part of my teaching".

As a result of the Technology Workshop, Teacher One reported becoming "a fiber optics nut". The Technology Workshop leaders covered enough material without becoming too deep for the non-computer people. It was especially helpful for her to have the opportunity to practice on the system and be critiqued on her use of it.

> "This can only be a positive step for my future as a teacher in a high school in rural Iowa. The Technology Workshop made me aware of some good teaching

> practices. I hope to use them on the system in the future".

Regional Coordinator

Teacher One reported that the distance education Regional Coordinator and her own school district have not influenced her use of ICN due primarily to two problems: money and lack of communication.

> "Without either, we out in the boondocks feel as if we are sinking". Announcing ICN programs and opportunities only through building principals did not appear to be an effective route. "Letters to my principal are not enough. Often I do not receive needed information".

This teacher's distance education involvement has been less than she would like. She used the ICN to present material to other teachers concerning her use of children's literature in high school English classrooms, and she hoped to increase her future use of the network. She asked to be put on the committee which meets regularly over the system in order to keep in touch and up to date on what is happening. She also has plans to share over the system with an English teacher in a neighboring community. Finally, she was hopeful that there will be information forthcoming concerning events on the system which might be of benefit to her classes.

Local School/Community

This teacher felt that a strength of her school climate was that administrators are very willing to let teachers try anything they might want. "My administrators have been supportive and encouraged my use of the network and attendance in conferences".

A drawback has been that district personnel have all become so busy that it has become impossible to get much accomplished. "Even though we are encouraged to try new avenues and taste new products in education, the time is just not there. Neither is the money". This teacher strongly suggested that more people in her district be encouraged to get involved in the network and the programs which revolve around it. She felt that involvement would eliminate some of the jokes concerning "cable people" and "computer nuts".

> "I have had very little positive feedback from some colleagues; in particular the math and science people were "turned off" after their workshops, so they have not been responsive to my enthusiasm for it. I really have not had a person in my building who has encouraged this network".

Conclusion

Overall, Teacher One felt that participation in the distance education project contributed to a dramatic change in her view of education.

> "These past two years have opened my mind to possibilities. I want my students to experience the possibilities too. It is very clear to me that, although books are important, there is a world out there that books cannot make real. There are experiences that books cannot offer, and there are horizons to be explored that the network can offer that books will never touch."
>
> "There are not a lot of changes that I have made in my teaching, but I will say that I have become a strong supporter of the network and I continually speak up for its many possibilities. Our community is not rich, and most people are unwilling to spend tax dollars on this network. I am one of the network's strongest supporters".

In the opinion of Teacher One, the potential of the ICN is unlimited. The greatest potential is the ability ICN has to bring the world to rural Iowa. "Our limited resources will be doubled, tripled, etc. It will excite students about learning and open their world to possibilities this school system could offer". She offered a simple formula to help reach this potential; "We need MONEY; we need better COMMUNICATION; we need more KNOWLEDGEABLE TEACHERS; we need a COMMUNITY SUPPORT of this network".
Teacher One's greatest concern for the ICN seemed to be the lack of communication among those working with distance education.

> "It is strange that in an area which is strong on communication and since one of the purposes of the network is to help us communicate, that communication is sorely lacking. Solve the communication problem and the world will be an our feet".

She indicated that difficulty scheduling onto the network also makes teachers reluctant to use it. Time is a premium.

> "When we cannot get on the system or have to solve all kinds of problems to determine what is available, we will quickly find other ways to accomplish our educational purposes. Unfortunately, those other ways will probably not involve the network. What a waste for teachers, for students, and for the future".

Teacher Two

This teacher teaches in a small, rural Iowa community with approximately 425 students grades 9-12. She had five different preparations over the 1993-1994 school year;

During the past year following the Institute and the Technology Workshop, Teacher Two has been involved in very few ICN activities. She participated in a few fiber conferences with other educators which the Regional Coordinator organized. She was one of three teachers in her building involved in the distance education project, and she reported that she has tried to encourage colleagues in her school to become involved. Although she has not taught over "the system", she has used the equipment in the ICN classroom to teach some of her classes

Institute/Workshop

Teacher Two felt that both the Literacy Institute and the Technology Workshop greatly influenced her understanding and skill in distance education.

She felt that the purpose of the Literacy Institute was to get classroom teachers informed, visionary, and enthusiastic about the fiber optics. She thought the Institute was also designed to offer teachers in the same field fellowship and contact with each other in order to inspire each other and to train each other. This teacher enthusiastically reported that she left the Institute better informed and inspired to continue to receive training in distance education.

She felt that the Literacy Institute definitely met, and in many cases exceeded, her expectations.

> "I've benefited a lot from things in terms of oral interpretation, and I've used a lot of the materials that were given. I think one of the results was the vision thing of seeing that there's still a lot for me to learn and not getting in a rut. The number one thing is the inspiration that took place."

She stated that during the Institute she would have liked more time to meet specifically with colleagues who taught the same classes she did, but she benefited from all the curriculum sharing opportunities. Teacher Two reported that the contents of the literature update session and the focus of the Internet session during the Institute were less helpful to her in her present situation than other sessions. She did add that her region presented a second session on Internet. "It had people so fired up, and that's one area we're really behind in at my school. Unfortunately, we were not ever hooked up."

Teacher Two attended the Technology Workshop in order to receive more training and "hands on" use of the fiber optics. She thought that the Workshop was well organized and well taught.

> "I learned a lot about the use of computers over the system, audio visual, and the use of VCRs. Although, in my school, and I heard this from several of the other teachers, that most of them don't have VCRs that seem to be able to play over the system or they don't have computers to actually use over the system. It's really nice, the interactive video and stuff, but nobody really seems to have it. In the ICN classroom we don't have a VCR that is hooked up. We don't have a computer".

This teacher would liked to have seen the Technology Workshop even longer than three days with more opportunity to practice teaching with "the system". She indicated that she has become more computer literate as a result of the Workshop. "I hope that I can learn more. So I think the vision thing again, expanding our horizons is the most important thing".

Regional Coordinator

Teacher Two indicated that the Regional Coordinator has had little influence on her use of the ICN, although the Coordinator would frequently invite the teachers to ICN-related activities. The Regional Coordinator organized three ICN sharing sessions for teachers which Teacher Two attended. She recalled that assessment was the topic of one of the sessions. Teacher Two invited colleagues in her building to attend and observe or participate in order to experience the system.

Teacher Two was concerned about the communication among the various strands involved with the ICN. For example, the English teachers in her school were angry because they didn't know there was going to be an advanced placement English course offered over the ICN. The students knew it before the teachers did, and signed up for the class through the guidance counselor. This teacher added that she would liked to have been free during that hour to observe the fiber AP English class and to learn.

Teacher Two added that she would have liked information on when teachers from various schools were going to be talking about certain things over the system.

Teacher Two indicated that the Regional Coordinator was accessible, but she had contacted that office only once, maybe twice, during the past year. She thought that it would help if the Regional Coordinator was more visible in the schools and if that office could assist in communicating ICN needs to local school boards.

> "Apparently money seems to be a problem. We can holler all we want but if they say we're not going to release you than it's all to no avail. If people can go to things and they have to take a professional day or something, maybe the school will release them, but you can't miss too many days or your students will suffer. You have to pick and choose."

Local School/Community

Teacher Two indicated the she works with a principal who is a visionary. He has attended the Technology Workshop and has encouraged his teachers to become involved in distance education. For example, he has been willing to release teachers for ICN-related activities. "I think basically he would just be delighted if one of us could teach over the system". Teacher Two indicated, however, the desire for a stronger leadership role from her principal. "I would really like to see him more aggressively help to channel us into good courses, and help us think through possible courses we could be teaching on the system and then to make the time for it". She sees distance education as a prime topic for staff development.

She and the other two teachers in her building that were trained in distance education seem to share a common vision for the ICN. Those two teachers are more active in their use of the ICN, although she has never had the opportunity to observe them teaching over the system.

Teacher Two felt that her other teaching colleagues do not seem very motivated to be involved in distance education or other educational innovations, and this is a frustration for her.

> "They don't want to mess around with it. They lecture; they sit on a desk and talk in a monotone. It's tedious. The kids are bored out of their socks. There's active learning going on in very few of the classes. I'd say out of our 45 teachers there's only 5 who are innovative and bubbly."

She felt that there are even colleagues of hers that view distance education as a threat to their teaching position. "Things need to be explained very well to them that no it is not going to take jobs away. If anything it's going to add jobs because of the preparatory time needed to be a teacher on this thing".

Conclusion

Teacher Two seemed anxious to become more active with distance education. She said that she would like to have more fiber conferences with other teachers. and would like to use the ICN to train speech contest judges. "All of us know English teachers and who have an interest already but who or can't come to the speech teacher's convention in Des Moines to renew their certification in judging. They could do it over the system". She suggested the even speech teacher meetings could take place via ICN.

Teacher Two emphasized that school boards need to catch the vision and support principals and teachers financially as they experiment with distance education. This is especially crucial due to the budget constraints of local schools. "If grant money was available to put into high schools to free people like myself who have a vision for this, I could use that time to prepare courses."

Teacher Two felt that financial concerns have contributed to ICN not approaching its potential. "The school board seems kind of hesitant or afraid or they think of the cost, and they don't have the money". She had made several suggestions to administrators concerning various speech activities with other schools. One of the concerns raised by administrators was financial concerns and "how we could do it-lack of belief" This teacher felt that a prevailing attitude is that ICN activities would take a lot more release time for teachers to prepare and that ICN would cost more money.

She indicated that the ICN could offer the advantage of extending curriculum and extending students' environmental boundaries. She also sees ICN potential in additional courses for teachers...continuing education and inservice... as well as a vehicle for additional communication between schools. She added that the ICN has not begun to realize its potential.

Summary

Data were gathered in order to determine how the support structure (i.e., Literacy Institutes/ Technology Workshop, Regional Coordinator, local district administration/faculty) affected the utilization of distance learning in education among literacy teachers. Two dimensions of the Concerns-Based Adoption Model (CBAM) were used along with individual interviews. Data were triangulated by means of documents, questionnaires, and interviews.

The 30 teachers who participated in a five-day, 1993 Teacher Education Alliance Literacy Institute were asked to complete a 35-item Stages of Concern Questionnaire (SoCQ) Four of these teachers were invited to participate in the study. Members of the study group were asked to submit a biweekly log for seven months in which they recorded encounters with distance education (e.g. conversations, articles read, lessons prepared and taught, lessons facilitated etc.). At the end of the seven months, two of the four teachers were individually interviewed about their distance education activities and the effect of the support structure in implementing distance education activities.

The individual stages of concern percentile scores for the 28 Literacy Institute participants who returned the questionnaire were typical of respondents at the initial phases of an innovation. Thirteen (64%) of the teachers were at the SELF dimension. That is, many of the respondents were aware of and concerned about distance learning in education and were interested in learning more about the innovation. None of the teachers were at the TASK dimension and ten (36%) of the teachers were at the IMPACT dimension (Stages 4, 5, or 6). Many other respondents were concerned about the collaborative aspects of distance learning in education (Stage 5).

The log entries of the study group members indicated that the ICN classrooms were being used. A variety of student experiences took place, however none of the classroom activities described were initiated by Literacy Institute participants or received by them. Only one of the classroom activities described, the elementary students' interviews of Native Americans, might be considered "English/Language Arts related". Logs did praise the ICN advantage to rural Iowa as a means to save time in travel and to allow teachers to get professional help. However, there appeared to be little ICN activity related to inservice or professional networking. No reference was made concerning the school administrators' role in encouraging or supporting ICN classroom activities.

None of the teachers' logs mentioned communications from Teacher Education Alliance personnel. Each Literacy Institute participant would have received the Teacher Education Alliance newsletter, the TEA Times. Nineteen issues have been published. In addition the Literacy Institute participants were sent three communications from the TEA Literacy consultants responding to ongoing Institute concerns: censorship, assessment, and standards. They were also informed of whom to contact concerning procedures for initiating school electronic mail hook-up. In addition, there was scant mention of any contact with or communication from the regional star school coordinator.

Two of the teachers were interviewed. The interview responses were analyzed to identify the teachers' Level of Use of distance education and to identify the needs within the support structure to enhance distance education activities. The teachers' responses indicated that both were at the Preparation Level. That is, each teacher has acquired information about distance education from the support structure, and were preparing to become involved in distance education with assistance from the support structure. The interviews indicated that the teachers were enthusiastic about the concept of distance education and the potential of the ICN for growth for both students and teachers, but reported slow adoption of widespread use of "the system". Neither mentioned a "barrier attitude" toward the technology, or hesitancy on the part of administrators. In fact, in both cases the immediate leadership was supportive. The teachers did express disappointment in the inefficiency of scheduling ICN use and also expressed concern for the isolation of rural teachers and students.

The teachers interviewed were very positive about the training that was part of their introduction to distance education. The contents, the organization, the climate and the personnel of both the Literacy Institute and the Technology Workshop were highly praised. It would appear, however, that in the individual districts and regions, the amount of support and reinforcement did not sustain the initial enthusiasm or did not develop the initial interest to the point that the teachers initiated or sought out ICN activities for themselves or for their students. Their comments indicated that the total school climate was not supportive of the distance education innovation.

Even these experienced teachers needed continued guidance, encouragement and suggestions from leadership. This did not appear to be adequately available at the local level, from the Regional Coordinator or from the Teacher Education Alliance personnel. Some of the teachers' comments suggest a prevailing attitude that the school use of the ICN is/should be relegated to transmitting coursework. For example one teacher wondered,

> "Can a regular speech teacher teach over the system or do you indeed have advanced calculus or something really new and innovative? I think that some of the teachers feel that, that they're not good enough, smart enough, or by gosh, don't know if anyone likes them. That's one of the problems, that inferiority thing." During the majority of the interviews, scant mention was made of innovative use of the ICN for "special activities."

Evidence gathered suggested that elements within the support structure that needed to be modified in order to strengthen the utilization. Ultimately, it is the opportunity for meaningful involvement, professional development and institutional support that are the key factors in promoting faculty receptivity and significant contributions to distance education programs.

- Teachers will need assistance in assuming ownership of the ICN. It is possible that they perceive the system as outside their locus of control.

- Teachers require easier access to information and to resources as well as the time to access these resources.

- Teachers can greatly benefit from interaction with peers as they wrestle with the teaching demands and rewards of distance education. This could be as simple as exposing faculty to case studies of successful distance education activities as well as encouraging faculty to attend state and regional education conferences and familiarizing them with journals specializing in distance education.

- Schools or regions should establish an ACTIVE distance education services team or advisory board across departmental lines to keep information and training current. Staff development endeavors must address ICN teaching techniques:
    - methods to establish and maintain effective communication between teacher and students;
    - methods to increase interaction among students;
    - strategies for encouraging individual and group motivation;
    - techniques for planning and managing organizational details;
    - awareness of the time demands of distance delivered courses.

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Usefulness of the Iowa Communications Network for Delivering Instruction in Secondary Agriculture Programs

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Introduction

In the book Understanding Agriculture, the National Research Council (1988) maintained that for agricultural education to grow and prosper educators should borrow from the best current programs while creating new ways to deliver agricultural education. The implementation and spread of distance education technology may represent one way to answer this challenge.

Distance education offers a viable opportunity for agricultural educators to battle declining enrollments, increased graduation requirements, decreased funding, and changing clientele. Distance learning provides students with opportunities to enroll in courses they may not have had the opportunity to experience previously and allows schools to offer subjects for which they have no qualified instructors (Swan, 1992). If distance education technology is such a powerful instructional tool, why aren't more teachers, particularly agriculture teachers, utilizing this technology?

Faculty resistance is often listed as the major barrier keeping distance education technologies from being implemented (Dillon & Walsh, 1992). Negative teacher attitudes, additional workloads, lack of funding, reduced student interaction, lack of time, and technical problems have all been identified as obstacles to the adoption of distance education technologies (Dillon et al., 1992; Hansford & Baker, 1990; Jackson & Bowen, 1993; Jurasek, 1993). However, the same researchers found that faculty with distance teaching experience generally had more positive attitudes toward technology mediated instruction. What attitudes are currently held by secondary agriculture teachers in Iowa toward telecommunicated instruction, and what obstacles do they perceive to be most inhibiting to the use of the Iowa Communications Network?

As the field of agriculture continues to develop rapidly, agricultural education programs must keep pace. Distance education technologies may be able to facilitate the modernization and improvement of secondary agriculture programs. Several curriculum initiatives in agricultural education are currently being promoted. Which curriculum initiatives are perceived to be priority areas by secondary agricultural education teachers? Can certain priority initiatives be accelerated through distance education? What courses can agriculture teachers offer through the ICN to schools that currently do not have agriculture programs? A need exists to identify priorities for agricultural distance education related to specific courses and units of instruction suitable for delivery via the ICN.

Purpose and Objectives

The purpose of this descriptive study was to investigate the usefulness of the ICN for agricultural education at the secondary level. The specific objectives of this study were to:

1. Describe obstacles that may inhibit the use of the ICN as perceived by secondary agriculture teachers.

2. Describe secondary agriculture teachers' attitude toward using the ICN for delivering agriculture instruction to youth and adults.

3. Identify priorities for collaboration among secondary agriculture programs in delivering instruction over the ICN.

4. Identify courses offered in secondary agriculture programs that are suitable or unsuitable for delivery via the ICN.

Procedures

Population and Sample

The population for the study consisted of all secondary agriculture teachers in Iowa (N=216). The frame for the study was developed from lists supplied by the Iowa Bureau of Career Education and the Agricultural Education and Studies Department at Iowa State University. The lists were cross-referenced to minimize frame error. Based on Krejcie and Morgan's (1970) formula for a five percent margin of error, a random sample of 140 teachers was drawn.

Instrumentation

The questionnaire utilized in the study consisted of four parts including attitude toward using the ICN, obstacles that may inhibit use of the ICN, priorities for collaboration and course offerings, and selected demographic questions. Content and face validity for the questionnaire were established by a panel of experts in agricultural education.

Obstacles that may inhibit the use of the ICN by secondary agriculture teachers were identified by interviewing persons responsible for administering different aspects of ICN, agriculture teachers not included in the sample, and from an instrument used by Swan (1992) for a similar purpose in North Dakota. Response categories for the 16-item Likert-type scale ranged from insignificant (1) to significant (6). Teacher attitude toward the ICN was measured with a 28-item Likert-type scale, with five response categories ranging from strongly disagree (1) to strongly agree (5). Both instruments were tested for suitability and reliability with a group of 10 secondary agriculture teachers not included in the sample. Cronbach's alpha was used to estimate the internal consistency of the instruments. The reliability coefficients were .82 for the obstacles scale and .93 for the attitude scale.

Data Collection

Data were collected by mailed questionnaire. The questionnaire, along with a cover letter and a stamped return envelope, was sent to all secondary agriculture teachers included in the sample. After 10 days, a second mailing was sent to all nonrespondents. Ten days after the second complete package was mailed, a reminder letter was sent to all nonrespondents stressing the importance of their participation. Approximately 10 days after mailing the reminder letter, telephone calls were made to the nonrespondents. One-hundred and two teachers completed and returned the questionnaire for a response rate of 73%. Non-response error was controlled by comparing early to late respondents (Miller & Smith, 1983). No significant differences were found between early and late respondents.

Results

The agricultural educators who participated in the study ranged in age from 23 to 64 years. The mean age of respondents was 36.94 with a standard deviation of 9.50. In regards to gender, 90.2% (92) of the respondents were male.

The agricultural education teachers were asked to report their highest level of education. Bachelors degrees were held by 71% (66) of the teachers, 26.9% (25) of the teachers held masters degrees, and 2.2% (2) of the teachers held doctoral degrees. The agricultural education teachers were also asked to indicate the number of years they had taught agricultural education, and whether or not they had tenure. Years of experience ranged from 1 to 35 with a mean of 12.44 and a standard deviation of 8.51. Approximately, three-quarters (77) of the teachers had tenure in their current positions.

The teachers were asked if their school was currently connected to the ICN. They were also asked if they had ever taught or taken a class via the ICN. At the time of this study, 22.5% (22) of the schools represented by the agriculture teachers were connected to the ICN. None of the agriculture teachers had taught using this technology. Nine teachers (8.8% indicated that they had taken at least one course via the ICN.

The teachers responded to sixteen statements representing obstacles which might inhibit their use of the ICN. A Likert-type scale with response categories ranging from insignificant (1) to significant (6) was utilized. Table 1 shows that 48% (49) of the teachers provided a mean score in the range of 4.51 to 5.50 (moderately significant). Approximately 39% of the teachers reported mean scores in the range of 3.51 to 4.50 (slightly significant). Mean scores in the range of 1.51 to 3.50 (moderately or slightly insignificant) were reported by less than eight percent (8) of the teachers. The overall mean score for the 16 obstacles was 4.49 (slightly significant) with a standard deviation of .63.

Table 1

Overall Mean Scores for Obstacles that May Inhibit the Use of the Iowa Communications Network by Agriculture Teachers

Mean	f	%	Cum %
1.51-2.50	1	1.0	1.0
2.51-3.50	7	6.8	7.8
3.51-4.50	38	39.3	47.1
4.51-5.50	49	48.0	95.1
5.51-6.00	5	4.9	100.0
Total	102	100.0	100.0

Mean 4.49 Std. Dev. .63

Note: Based on Scale: 1 = insignificant; 2 = moderately insignificant; 3 = slightly insignificant; 4 = slightly significant; 5 = moderately significant; 6 = significant

Table 2

Percentage of Teachers Who Selected Slightly Significant, Moderately Significant, or Significant for Each Obstacle

Obstacle		%
1.	Coordination of schedules between schools	94.1
2.	The ICN could create scheduling problems	88.2
3.	Laboratory sessions cannot be taught via the ICN	87.3
4.	Distributing materials between sites	87.3
5.	Lack of local support staff	87.3
6.	Supervised agricultural experiences cannot be managed via the ICN	86.3
7.	Costs associated with using the ICN	85.3
8.	Lack of training	83.3
9.	Preparation time needed by teachers	82.4
10.	Fear that the ICN would reduce the number of agriculture programs	78.4
11.	Agriculture teachers are too busy to teach via the ICN	77.5
12.	Lack of incentives for teaching	77.5
13.	Administrators do not understand teachers' needs when teaching via the ICN	77.5
14.	Difficulty in establishing cooperative relationships among schools	68.6
15.	Negative attitude of teachers towards ICN	61.8
16.	Lack of student interest	58.8

Table 2 shows the percentage of teachers who selected slightly significant, moderately significant, or significant for each of the sixteen obstacles. School and class scheduling problems were considered most significant by the agriculture teachers. Lack of local support staff, the inability to conduct lab sessions, and materials distribution were each considered significant, moderately significant, or slightly significant by 87.3% of the respondents. Costs, training, and preparation time were considered obstacles by 80-85% of the agriculture teachers. The obstacles receiving the lowest frequency of responses in the slightly significant, moderately significant, and significant categories were lack of student interest and negative attitudes of teachers toward the ICN.

On a five-point Likert-type scale, teachers were asked to respond to 28 statements related to their attitude toward the use of the ICN to teach agriculture. Table 3 reveals that 62.7% (64) of the teachers provided a mean score in the range of 2.51 to 3.50 (undecided). An additional 32% (33) of the agriculture teachers reported a mean score in the range of 3.51 to 4.50 (agree). The remaining 4.9% (5) of the respondents provided mean scores between 1.51 and 2.50 (disagree). The overall mean score for the 28 attitudinal statements was 3.26 (undecided) with a standard deviation of .47.

Agriculture teachers were asked to list units of instruction that they would like to receive from other agriculture programs through the ICN. A total of 275 units of instruction were listed by the 102 agriculture teachers participating in the study. Units of instruction were placed into 12 content-related categories by the researcher. Table 4 shows that units related to agricultural economics (25.8%) were listed most frequently as priority units for reception. Horticulture, floriculture, and landscaping units (13.8%) were the second most frequently cited units followed by animal sciences (11.2%), agronomy (9.5%), aquaculture (9.5%), agricultural mechanics (8.3%), and biotechnology (5.5%). Categories representing less than five percent of the total number of units included natural resources and the environment, careers in agriculture, computers, and leadership, FFA and SAE. Approximately six percent of the units were grouped into a miscellaneous category and included such units as forestry, food technology, international agriculture, and agricultural journalism.

Agriculture teachers were also asked to list units of instruction that they would be willing to teach via the ICN. A total of 164 units of instruction were listed by the 102 agriculture teachers who participated in the study. Table 4 shows that units related to animal sciences (25.6%) were listed most frequently as priority units for delivery. The second most frequently cited category was agricultural economics (23.2%) followed by agronomy (11.6%), horticulture, floriculture, and landscaping (8.5%), agricultural mechanics (7.3%), and leadership, FFA, and SAE (5.5%). Categories representing less than five percent of the total number of units included natural resources and the environment, computers, careers in agriculture, biotechnology, aquaculture, and the miscellaneous category.

Due to the nature of the instruction in secondary agriculture programs, it could be hypothesized that only select course offerings are suitable for delivery via the ICN. Agriculture teachers who participated in the study were asked to list titles of courses (semester or year-long) that could be delivered via the ICN to schools without an agriculture teacher. A total of 210 course titles were listed by the agriculture teachers. The researcher collapsed the course titles into nine categories which are presented in Table 5. Course titles related to agricultural economics (35.2%) were listed most often as courses that were suitable for delivery via ICN. The second most frequently cited category of course titles was agronomy (19.5%) and was followed by animal sciences (18.6%), horticulture, floriculture, and landscaping (5.7%), and natural resources and the environment (5.2%). Categories representing less than five percent of the course titles included agricultural mechanics, leadership, FFA, and SAE, and aquaculture. Approximately 11 percent of the course titles were grouped into a miscellaneous category and included such titles as agricultural communications, Iowa agriculture, agricultural issues, and agricultural chemicals.

Table 3
Overall Mean Scores for Agriculture Teachers' Attitude Toward Using the Iowa Communications Network to Teach Agriculture

Mean	f	%	Cum %
1.51-2.50	5	4.9	4.9
2.51-3.50	64	62.7	67.6
3.51-4.50	33	32.4	100.0
Total	102	100.0	100.0

Mean 3.26 Std. Dev. .47
Note: Based on Scale: 1 = strongly disagree; 2= disagree; 3= undecided; 4= agree; 5=strongly agree

Table 4
Categories of Priority Units of Instruction that Agriculture Teachers Desire to Receive or Would be Willing to Deliver via the ICN

	Receive		Deliver	
Unit	f	%	f	%
Agricultural Economics	71	25.8	38	23.2
Horticulture/Floriculture/Landscaping	38	13.8	14	8.5
Animal Sciences	31	11.2	42	25.6
Agronomy	26	9.5	19	11.6
Aquaculture	26	9.5	4	2.4
Agricultural Mechanics	23	8.3	12	7.3
Biotechnology	15	5.5	4	2.4
Natural Resources/Environment	13	4.7	6	3.7
Careers in Agriculture	6	2.2	4	2.4
Computers	5	1.8	5	3.1
Leadership/FFA/SAE	4	1.5	9	5.5
Miscellaneous	17	6.2	7	4.3
Total	275	100.0	164	100.0

Table 5

Categories of Priority Courses That Could be Offered via the ICN to Schools with no Agriculture Teacher

Course	Suitable		Not Suitable	
	f	%	f	%
Agricultural Economics	74	35.2	9	4.8
Agronomy	41	19.5	19	10.2
Animal Sciences	39	18.6	12	6.5
Horticulture/Floriculture/Landscaping	12	5.7	30	16.1
Natural Resources/Environment	11	5.2	5	2.7
Agricultural Mechanics	6	2.9	88	47.3
Leadership/FFA/SAE	3	1.4	8	4.3
Aquaculture	1	.5	5	2.7
Miscellaneous	23	11.0	10	5.4
Total	210	100.0	186	100.0

Agriculture teachers were also asked to list titles of courses (semester or year-long) that would be unsuitable for ICN delivery. A total of 186 course titles were listed by the agriculture teachers. Table 5 shows that agricultural mechanics courses (47.3%) were most frequently cited as not suitable for ICN delivery followed by horticulture, floriculture, and landscaping courses (16.1%), agronomy courses (10.2%), animal science courses (6.5%), and miscellaneous course titles (5.4%). Categories representing less than five percent of the course titles included agricultural economics, natural resources and the environment, leadership, FFA, and SAE, and aquaculture.

Conclusions and Recommendations

Overall, the 16 obstacles to using the ICN in secondary agriculture programs were perceived to be slightly significant. Teachers were most concerned with scheduling problems, but were also concerned that laboratory sessions and Supervised Agricultural Experiences could not be managed over the system. Additionally, the respondents were concerned with costs, lack of training, and incentives for using the system.

Perhaps scheduling, training, and incentives are less problematic than concerns related to S.A.E. and laboratory experiences. Can quality programs in agricultural education be delivered while sacrificing the foundations (S.A.E. and laboratory experiences) upon which agricultural education was built? Do agriculture teachers really have to sacrifice these components of an agriculture program? It is recommended that pilot or demonstration programs be developed that include laboratory and hands-on learning experiences within the interactive distance education delivery mechanism. The interactive and video components of distance education should be exploited to demonstrate viable alternatives to conventional methods of teaching agricultural education.

Data suggest that secondary agriculture teachers are undecided about using the ICN as a tool for teaching agriculture. If attitudes are a reflection of an individual's personal perspective and are strongly predictive of behavior, what does this tell us about agriculture teachers' willingness to use this educational technology? Perhaps Lionberger's (1982) adoption process theory, which includes awareness, interest, evaluation, trial, and adoption could explain the current situation. Currently the ICN is connected to less than 25% of the schools in Iowa which have agricultural education programs. It is recommended that teacher educators provide secondary agriculture teachers with current information related to the ICN to increase awareness and stimulate interest. Also, secondary agricultural education teachers should be provided opportunities, both as a recipient and provider of distance education, to gain experience with the ICN technology. Studies in technology and distance education have shown that teacher attitudes become more positive as a result of experience with technology (Rollins, 1993).

The highest priority for collaborative efforts among schools with agriculture programs were in the areas of agricultural economics and horticulture. Teachers also cited units of instruction (aquaculture and biotechnology) that are related to current curriculum initiatives in agricultural education as priorities for collaboration. Teacher educators should plan, organize, and deliver inservice education for agriculture teachers in curriculum development and strategies for lesson presentation particularly for agricultural economics and horticulture related units. The data suggest an adequate number of teachers are willing to teach units of instruction in the priority areas via the ICN. Teacher educators should promote the involvement of secondary agricultural education teachers in using the system to improve agriculture curriculum in secondary agriculture programs throughout Iowa.

Interestingly, different teachers perceived the same content-related categories of courses to be both suitable and unsuitable for delivery via ICN to schools with no agriculture teacher. A clear pattern was evident regarding the suitability of agricultural mechanics courses and agricultural economics courses. Teachers generally agreed that agricultural mechanics courses were not suited to ICN delivery, but agricultural economics courses were suited to ICN delivery. Teacher educators, secondary agriculture teachers, administrators and others with an interest in agriculture should work collaboratively to facilitate the delivery of instruction in and about agriculture to schools without agriculture teachers. The teachers who participated in this study placed considerable emphasis on agricultural economics, but agronomy and animal sciences courses were also listed as promising areas for course delivery.

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Community College Demographics and Innovativeness Toward Distance Education: Is there a correlation?

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The purpose of this study was to see if distance education was related to institutional characteristics. The perceived level of distance education innovativeness was determined by having community college individuals complete the Distance Education Survey (DES). DES scores were correlated with information obtained by the Community College Information Survey (CCIS) to discover if a relationship existed.

A variety of factors may have influenced whether a community college is innovative toward the Iowa Communications Network (ICN). It was hoped that it would be possible to determine if relationships existed between variables by correlating the data.

Review of Chapter I, II, and III

Research Questions

In order to accomplish the purpose of this study, the following research questions were developed:

1. What relationship do Iowa community college institutional characteristics have to the college's perceived level of distance education innovativeness?

2. What generalizations about ICN usage can be made from information gathered about each institution?

3. What are the characteristics of community colleges whose DES scores indicate they are most innovative and least innovative toward distance education?

Review of the Literature

A review of the literature addressed five areas of concern: (a) examples of two-way interactive distance education, (b) distance education and cost, (c) theories related to distance education, (d) research pertaining to organizational innovativeness, and (e) examples of innovativeness characteristics studies.

Many states have turned to distance learning to solve educational problems. Large rural areas and limited economic resources are two problems that educators feel distance education can remedy (Currer, 1991). When a state implements a new technology, cost becomes an important variable. Iowa community colleges discovered cost was a major factor as they connected to the ICN (Roos, 1991, October 15).

There are a variety of theories related to distance education. Keegan (1986) organized theories into three areas: (a) theories of autonomy, (b) theory of industrialization of teaching, and (c) theories of interaction and communication. A fourth theory category investigated a clarification of distance education through the formation of communication and diffusion, as well as philosophies of education (Schlosser & Anderson, 1993). Rogers' diffusion of innovation theory was the theory base for this study.

Organizational innovativeness was important because community colleges are organizations. Several types of systems have been the focus of organizational research. They include: (a) businesses, (b) religious organizations, (c) government agencies, and (d) educational institutions. Rogers also discussed organizational innovativeness. He found several shortcomings in these studies and suggested remedies for further research.

The literature review found few research studies that correlated innovativeness and organizational characteristics. Two characteristics studies were discussed in depth. Carr (1985) conducted a study of Florida vocational educators to determine their attitudes toward educational change and how flexible they were. Two of five key research questions involved demographic factors and whether they were predictive of their attitude and innovativeness. Dennison and Behnke designed a study "to determine the extent to which innovative activities vary among Canada's community colleges and to what degree specific organizational characteristics correlate with institutional innovativeness" (Dennison & Behnke, 1993, p. 233). These studies were similar to this research because they examined the impact characteristics have on innovations.

Methodology

Three types of instruments were designed for this study. The Distance Education Nomination Form (DENF) was strictly used for the identification of persons who were knowledgeable about distance education at each community college. The DES was designed to measure organizational innovativeness in distance education. The CCIS was designed to gather general community college, enrollment, graduation and distance education information.

Community college presidents were asked to name three individuals: (a) telecommunications leaders, (b) vice-presidents of academic affairs, and (c) instructors who taught on the ICN. These individuals completed the DES. The CCIS was sent to each community college president's office.

Discussion of Results

General Scores on DES

The DES was designed to measure distance education innovativeness. The instrument produced one score. A low number indicated the community college was more innovative toward distance education. Individual Iowa community college DES scores ranged from 25 to 100. The mean and standard deviation of all scores were 61 and 19.1 respectively. When examining averaged community college scores, the numbers ranged from 35.7 to 81. The mean and standard deviation for the averaged scores were 61.16 and 13.14 respectively.

On the possible scale ranging from 25 to 175, all Iowa community colleges scored on the innovative end. There were no DES scores above 100. Since DES information was gathered from individuals at each institution, the scores explained several things. Many officials believed that their institutions were innovative toward distance education.

DES scores from each institution also tended to be consistent. With the exception of four institutions, individual scores from each community college tended to cluster together. This demonstrated that many officials felt the same way about their community college's innovativeness toward distance education.

When the scores were placed on a continuum, community college E had lowest DES score and community college K had the highest. A comparison of the two community colleges' CCIS characteristics showed similarities and differences in several areas. Areas that were similar included (a) budget, (b) number of main campuses and attendance center, (c) average age of student population, (d) construction an additional classroom, (e) how the classrooms would be paid for, (f) training for instructor, and (g) on-site coordinators at each satellite campus.

Community colleges were different in a few areas. Community college K's budget rose slightly during the past five years while community college E did not change. When examining budget trends, community college E's past trend was rising a little, while community college K's rose considerably. Community college E reported no change in projected enrollment over the next five years while community college K thought theirs would rise slightly.

With questions involving distance education, the projected time for completion of a new classroom differed. Community college E stated theirs would be constructed within six months while community college K thought theirs would be ready within one year. Classes taught on the ICN differed considerably. During the spring of 1994, community college E's faculty taught three classes over the ICN while community college K's taught nine. Community college K formed a telecommunications committee and did student advising over the network. Community college E gave their instructors financial compensation to teach over the ICN but did not reduce their teaching load. Also, they developed a distance education teaching manual.

Several conclusions can be made from this comparison. A community college's DES score was not indicative of what a community college was doing in distance education. An institution with a lower DES score should probability be teaching many classes over the ICN, have a telecommunications committee, and reduce the teaching load for their instructors. When comparing the lowest and highest DES score, the lowest (more innovative) community colleges lacked some of these characteristics.

Second, individuals were apparently perceiving distance education innovation differently than what was actually occurring at their institution. Community college K was doing a lot in the area of distance education. Their faculty taught nine classes over the ICN during the spring of 1994. They were giving instructors reduced teaching loads for working on the ICN, and had developed a telecommunications committee. This was more than community college E had accomplished.

There was no apparent relationship between institutional characteristics and the perceived level of distance education innovativeness. Iowa community colleges seemed to have moved at their own pace with regards to distance education. The use of it at each institution depended on need at that particular time. Community colleges who saw distance education filling a particular role moved quickly and could be considered more innovative. DES scores did not necessarily reflect that.

Summarization of CCIS Characteristics

Several generalizations can be made about Iowa's community colleges by examining the CCIS. Valuable information was gained in what community colleges are doing in distance education and the ICN. This information can be used as baseline data and be tested in future years to see if progress is being made.

Seventy eight percent of the community colleges were planning on adding an additional classroom. Of those colleges interested in installing a new classroom, over half anticipated the room to be completed within six months. A majority of schools stated the classrooms would be paid for from the community college budget. This figure demonstrated that many of the institutions were interested in getting more actively involved in distance education.

Current community college involvement in the distance education ranged from one to 18 courses being taught. The average among the 12 colleges responding to the question was six.

Community colleges used a variety of methods for selecting instructors to teach over the ICN. Methods utilized by them included: (a) course need, (b) voluntary basis, (c) those who had training on the ICN, (d) instructor availability, (e) teacher effectiveness, (f) interviews, and (g) instructor interest in distance education. Iowa's community colleges selected ICN instructors using different techniques. There has not been a standardized set of criteria established by the institutions for selecting instructors.

In the area of preparation, nearly all of the community colleges reported they trained instructors in distance education. Sixty one percent of the institutions reimbursed educators for teaching on the network. At many institutions, however, instructors did not receive a reduced teaching load. These statistics can be evaluated in several ways. The data showed that community colleges supported instructors who were interested in distance education. The institutions provided educators with training and many of them received monetary reimbursement. Institutions seemed to fail to realize, however, that distance education teaching takes considerable preparation. Providing educators with a reduced teaching load might have encouraged other instructors to consider working on the ICN.

Correlations Between DES Scores and CCIS Data

Correlations were calculated between community college DES scores and information obtained on the CCIS to determine whether there was an association between certain characteristics and averaged scores. This statistical analysis was used to answer the following research question.

Research Question 1. What relationship do Iowa community college institutional characteristics have to the college's perceived level of distance education innovativeness?

Relationships between DES scores and CCIS information, with the exception of one area, were not statistically significant. The one slightly significant correlation occurred between DES scores and the averaged number of years the respondents worked at their institution. (r=--0.43). The more years the respondent worked at the community college, the lower the DES score was.

Research Questions

Research Question 1
What relationship do Iowa community college institutional characteristics have to the college's perceived level of distance education innovativeness?

Correlations between DES scores and CCIS characteristics were minimal. One correlation was somewhat significant. The correlation between the averaged DES scores and the number of years spent by the respondents at the institution was calculated at -0.43.

Research Question 2
What generalizations about ICN usage can be made from information gathered about each institution?

Table 3 lists frequency counts for the results of the Community College Information Survey. Several generalizations can be made from this data. A majority of institutions planned on installing an additional ICN classroom. Most anticipated the classroom to be installed within six months. Nearly all the ICN instructors received technical and teacher training. Iowa's community colleges selected ICN instructors using different techniques. There has not been a standardized set of criteria established by the institutions for selecting instructors.

Research Question 3
What are the characteristics of community colleges whose DES scores indicate they are most innovative and least innovative toward distance education?

Table 2 lists the characteristics of community college E and K. Community college E had the lowest DES score indicating they were perceived as the most innovative toward distance education. Community college K had the highest DES score, indicating they were perceived as the least innovative. Community college K's budget rose slightly during the past five years while community college E didn't change. When examining budget trends, community college E's past trend rose a little, while community college K rose considerably. Community college E reported no change in projected enrollment over the next five years while community college K thought it would rise slightly.

With questions involving distance education, the projected time for completion of a new classroom differed. Community college E stated it to be constructed within six months while community college K though it would be within one year. Classes taught on the ICN differed considerably. Community college E taught three classes while community college K taught nine over the ICN during the spring of 1994. Community college K formed a telecommunications committee and did student advising over the network. Community college E gave their instructors financial compensation to teach over the ICN but did not reduce their teaching load. Also, they developed a distance education teaching manual.

Reactions to Results

The purpose of this study was to see if distance education was related to institutional characteristics. After correlating average DES scores and CCIS data, only one statistically valid conclusion could be made. The more years the respondent worked at the community college, the lower the reported DES score was. It was thought that there might be a relationship between institutional characteristics and distance education innovativeness. The results of this study did not support this. Iowa community colleges seemed to have moved at their own pace regarding distance education. Characteristics of the institution had little to do with distance education innovativeness.

In the fall of 1991, several Iowa community colleges stated their reluctance to join the ICN. Cost seemed to a contributing factor. Now, seventy eight percent of the institutions expressed interest in installing an additional ICN classroom. Funding for the classroom was coming to come from the community college's budget.

Rogers (1983) stated there were several variables that have been linked to innovativeness in an organization. Size was considered to be positively related to innovativeness. The larger the staff and budget were, for example, the more innovative the institution was. This study does not support Rogers' research. Size was examined through the variables of estimated annual budget and total student enrollment. Neither variable was found to have a statistically significant correlation.

This research, however, provided several interesting results regarding the ICN and community colleges.

- Nearly all of the community colleges were planning on adding an additional classroom.
- Over half of the community colleges that were interested in installing a new classroom wanted it to be constructed within six months.
- A majority of the community colleges stated the classrooms would be paid for from the community college budget.
- The number of courses taught over the ICN ranged from 1 to 18 classes.
- Nearly all of the community colleges trained their instructors in distance education.
- Instructors interested in distance education received monetary support but many did not receive a reduced teaching load.

Suggestions for Future Research

There is a need for additional research in the area of community colleges and distance education. Attitudinal research needs to be done to determine current attitudes. Many community colleges felt they were forced to join the ICN. Continuing costs of the network could effect an institution's position. Attitudes might also change as community colleges begin to see the benefits of distance education. Follow-up studies need to be conducted to determine if attitudes change.

This study should be duplicated with more subjects completing the DES. A truer picture of how innovative the community college is towards the ICN could be accomplished. Also, CCIS questions should be more specific. Inquiring about the types of classes taught and what specific type of training instructors received are two of the areas that could be explored further.

Summary

The purpose of the study was to see if distance education innovativeness was related to institutional characteristics. After correlating average DES scores and CCIS data, only one conclusion could be made. The more years the respondent worked at the community college, the lower the DES score was. Valuable information was gathered about what community colleges were doing in distance education. The summary of CCIS characteristics pertaining to distance education explored what community colleges were doing with distance education. The comparison of low versus high DES scores produced contradictory results. Community colleges with high DES scores were doing many positive things with distance education.

This research also gave impressions of what individuals working at the community colleges felt their institutions were doing with distance education. By averaging their scores, a single DES score was given to each community college. All averaged DES scores fell toward the innovative side of the scale. According to DES scores, participants must have thought their community college was moving in the right direction toward the ICN and distance education.

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Student Involvement in the Distance Education Classroom: Teacher and Student Perceptions of Effective Instructional Methods

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Introduction

Background

Distance education has become a phrase describing any system using one or more technologies to link teachers and learners from one location to another (Education Satellite Network, 1994). It was originally defined as education when the teacher and student were separated in time and/or space (Hardman, 1993; Stahmer, 1990). An additional characteristic was added to complete the definition--two-way communication between the teacher and student (Garrison, 1989; Stahmer, 1990).

Distance education has existed in one form or another since the early 1800s. In the past, distance education has been associated with independent study. Initially, the learning process in distance education consisted mainly of students working with print materials (Garrison, 1989). As communications technology improved, the face of distance education also changed. Bates, as cited in Garrison (1989), stated that new technologies now accessible to educators allow for more variety in teaching activities as well as a higher quality of learning and more interaction and feedback for students. Some of the techniques used for distance education have included: correspondence study, audio cassettes, and broadcast television (Feasley, 1983; Garrison, 1989; Hardman, 1993; Schlosser & Anderson, 1993). Each technique has its advantages and disadvantages.

Correspondence study originally referred to written instruction through the postal service (Verduin & Clark, 1991). Students participating in correspondence courses mailed assignments to their instructors. These instructors then added written comments and sent these back to the students. There was very little, if any, direct communication between teachers and students (Giltrow, 1989). There are many advantages to correspondence study, including: (a) access to the course is available to all interested students, (b) course can be completed when and where it's convenient for the student, and (c) material can be easily distributed to the students (Feasley, 1983; Garrison; 1989). There are also disadvantages to correspondence study (Garrison, 1989). The most important one is that the communication between teacher and student is much slower than what is found in the traditional classroom. Another disadvantage is that students do not have the opportunity to offer their suggestions as to what could be studied or how they learn best.

Using audio cassettes to deliver instruction at a distance is another technique for delivering education at a distance. Students are provided with audio cassettes containing recorded audio material. Assignments are completed along with the audio cassettes and then sent to instructors for their comments (Feasley, 1983). There are many advantages to using audio cassettes for distance education. Among these are: (a) easily available to all students, (b) completed when and where it's convenient for the student, (c) ability to stop and review content as needed, and (d) more humanizing teacher-student relationship (Feasley, 1983). The main disadvantage, similar to correspondence study, is that communication between teacher and student is not immediate. Another disadvantage is that a high percentage of recorded audio material is too slow in delivery and often not phrased appropriately for efficient listening. It is also difficult for the students to locate specific points in the lesson on the tape or to split monologues into important points that need to be answered (Feasley, 1983; Lappia & Kirkland, 1989; Verduin & Clark, 1991).

Broadcast television is another method that has evolved to deliver distance education. In broadcast television, the signal is beamed through the air to TV receivers without using wires or cables (Verduin & Clark, 1991). The main advantage to utilizing broadcast instructional television is that it combines both visual and audio communication (Garrison, 1989). Students can both see and hear the instructor. However, this communication is often only one-way. Students cannot communicate directly back to the instructor. There are other disadvantages to using broadcast instructional television. Among these are: (a) more planning time is required, (b) more money is required to produce courses, and (c) individual differences among students are often not recognized.

Since the 1950s, many people around the world have participated in some form of distance education as an option in place of traditional classroom-based education (Giltrow, 1989). Distance education efforts were initially directed toward adults with work, social, and family commitments. These adults were unable to attend classes on a college campus because of these commitments. These learners have, in the past, been described as students who are endowed with strong study skills, high motivation, and discipline (Hardman, 1993).

A strength of distance education has been that it could be utilized in a variety of ways to assist in meeting the specific needs of school districts. By expanding the resources available to all learners, it has the potential to improve the performance of students and teachers (Education Satellite Network, 1994). Courses provided via distance education can also transport people and experiences to classrooms to broaden traditional instructional practices or provide entirely new alternatives. They can link classrooms to homes, businesses, and other community locations and provide opportunities to reach parents, offer assistance with homework after the school day is over, or even create new groups of learners (Office of Technology Assessment, 1989).

In 1988, Congress initiated legislation to develop telecommunication activities to improve education for all students, especially those in small and/or rural schools (Education Satellite Network, 1994). The U.S. Department of Education introduced a program that focused attention on distance education in schools throughout the nation. The Star Schools Program started in the late 1980s to enhance instruction in mathematics, science, foreign languages, literacy skills, and vocational education for educationally disadvantaged schools and students through the use of telecommunications networks (Education Satellite Network, 1994; Office of Technology Assessment, 1989; Simonson, Sweeney, & Kemis, 1993). Many school districts across the nation, including those in Iowa, received funding to aid in the development of distance education programs. Because of the Star Schools Program, an alliance, made up of educational personnel in the State of Iowa, was created. An important purpose of the Iowa Distance Education Alliance (IDEA) was to prepare, support, and improve educational instruction in Iowa so students could receive effective instruction at a distance (Herring, Smaldino, Thompson, & Schoenfelder, 1993).

One of the newer models of distance education, interactive instructional television, is currently receiving a great deal of interest, especially in Iowa. Interactive instructional television utilizes television to link a teacher and students at multiple sites for live interactive instruction. It combines characteristics of live, interactive, visual, and audio communication (Hardman, 1993). Delivery systems using interactive instructional television include: microwave, instructional television fixed service (ITFS), and fiber optics.

Problem

Schools have utilized distance education in the past for numerous reasons, including: (a) lack of teachers in specific subject areas, (b) decreasing enrollments, (c) geographical isolation, and (d) limited course offerings (Clark, 1989). Beginning in the 1930s, distance education delivery systems branched out from correspondence education to include radio and television. Radio, as a delivery system for distance education, failed to gain the momentum it required to become an effective and lasting force in education. The reasons identified included: (a) difficulties with money and hardware (no or poor equipment, inadequate reception) (b) program content not matching the needs of schools, and (c) scheduling difficulties. Another reason given was educators being disinterested and apathetic toward this revolutionary means of communication. A final reason was the fact that schools were slow to act upon the technological changes in society (Cuban, 1986).

By the 1950s, television had replaced radio as a medium for the delivery of distance education. Cuban (1986) identified three different patterns of usage of broadcast instructional television in schools. First, the entire educational program was presented by a television teacher. The classroom teacher assumed the position of a supervisor for large or small groups of students. Second, broadcast instructional television was utilized as a supplement to classroom instruction by the teacher. The classroom teacher prepared his/her class to receive instruction from the television teacher. Then the classroom teacher was responsible for follow-up activities to the presentation. Third, the classroom teacher utilized broadcast instructional television as an aid to the learning process. It was used in a manner similar to films. The teacher decided when and how to allow televised instructional programs into the classroom.

Since broadcast instructional television was first introduced, people have been concerned with whether instruction via television was as effective as instruction delivered in a traditional classroom. Teachers in general are slow to adapt to technological changes in their classrooms. The simplicity, adaptability, and efficiency of other instructional tools such as textbooks and chalkboards are easier for teachers to use in dealing with the everyday problems found in the classroom. Also, teachers respond to problems by utilizing methods observed in the past from experienced teachers. Another reason teachers are slow to adapt to technological changes is that many teachers believe these changes affect the interpersonal relations between teachers and students necessary for student learning (Cuban, 1986).

Research is being conducted on a variety of issues associated with distance education. Many factors must be looked at, including the quality of interaction among students and teachers (Office of Technology Assessment, 1989). Teachers are worried about the quality of instruction found in interactive instructional television as well as the need for interaction with all of the students, including those at the remote sites. Interaction has been considered one of the two main stages of teaching. Interaction is when the teacher provides verbal stimulation, gives explanations, asks questions, and gives guidance (Giltrow, 1989). One weakness of televised instruction in the past has been the lack of human interaction. This type of instruction tended to separate teachers from students and students from other students (Chung, 1991). Distance education teachers have discovered that they need to create an interactive environment appropriate for the technology to aid in keeping the students' attention. Johnstone, cited in Office of Technology Assessment (1989), found that:

> The best way to learn new information is to receive it while in an active, rather than passive, state of consciousness...One simple method the instructor can use to assist the learner...is to do something that is never done on broadcast television: to talk directly to the distant learner and require a response at the very beginning of the session. (p. 93)

Distance education teachers can also aid in facilitating learning by their students by giving them opportunities to interact with other students and relate new information to prior understanding and knowledge (Office of Technology Assessment, 1989).

Therefore, an important issue to consider as distance education programs are developed is the identification of effective instructional methods in the interactive instructional television classroom which promote students' active involvement within their own learning. As they prepare to deliver instruction through interactive instructional television, teachers have requested help in identifying ways to promote active student involvement in the learning process (Office of Technology Assessment, 1989). Crow, as cited in Eble (1980), stated that research into the interactive processes supports a number of important outcomes, including: (a) students become active rather than passive participants in the learning process, (b) students retain the information longer, and (c) the instructor is able to receive informal feedback about the progress and attitudes of the students throughout the semester.

Purpose

The purpose of this study was to survey teachers and their students participating in an interactive instructional television course at a high school in Iowa. The questionnaire was administered to determine if instructional methods teachers identified as most effective in promoting students' active involvement in learning were perceived in this same way by the students in their distance education classrooms. The information gathered will be useful for teachers involved with interactive instructional courses in developing teaching activities that promote active student involvement.

Question

Do high school students' perceptions of effective instructional methods for promoting active student involvement within the interactive instructional television classroom differ from their teachers' perceptions of effective instructional methods?

Significance

Learning is an active and dynamic process with important components being communication and interaction. It can also be both an individual as well as a group experience (Herring et al., 1993; Willis, 1992). In order for learning to occur, students need educational environments that are creative and responsive to their needs. Using distance learning systems to deliver instruction can change the communication and interaction patterns between teachers and students. However, when special efforts are made by teachers to involve learners in classroom interactions, differences existing between traditional and distance education classrooms diminish. Distance education can actually improve learning experiences, broaden horizons, and promote group collaboration by exposing students to ideas, activities, and people not available in their schools.

A limited amount of research has been done on distance learning through interactive instructional television. A majority of this research has been done in higher education (i.e. community colleges and universities). Little of the research has been targeted specifically to the high school level. As a result of the Star Schools grant, many high schools in Iowa now have the opportunity to provide additional courses for their students through interactive instructional television. Most of the teleteachers for these courses will be coming straight from the traditional classroom setting. These teachers have little, if any, experience with teaching over interactive instructional television. Therefore, it is important for these teachers to understand what their students perceive as effective teaching strategies for promoting active involvement of students in their own learning within the interactive instructional classroom. Based on their students' perceptions, teleteachers can adapt, if necessary, their teaching style to better utilize interactive instructional television.

Limitations

This study was limited to students in high school courses taught by high school teachers in Iowa. Only three classes participated in the study consisting of 44 students and three teachers. Another limitation of this study was that only distance education courses that utilized two-way video and two-way audio were included.

Method

Research Question

Do high school students' perceptions of effective instructional methods for promoting active student involvement within the interactive instructional television classroom differ with their teachers' perceptions of effective instructional methods?

Research Design

The research consisted of a questionnaire designed to gather data about teacher and student perceptions concerning instructional methods for promoting active student involvement within an interactive instructional television course. This data could then be used by teachers to identify instructional methods that promote student involvement within an interactive instructional television course.

Sample

The sample population was comprised of high school teachers and their students in the State of Iowa participating in interactive instructional television courses that utilized two-way video and audio communication. The teachers and their classes were identified with the assistance of the Iowa Star Schools Regional Coordinators. Of the 11 teachers identified, three chose to participate in the research.

All three of the teachers were experienced teachers in the traditional classroom; two of the teachers taught for more than twenty years. None of them had taught an interactive television course. Of the 44 students in the study, the majority were juniors and seniors in high school who considered themselves "A" or "B" students. Ninety-one percent of the students were participating in their first interactive instructional television course. Eighty percent of the students were considering continuing their education at either a two-year or a four-year college.

Data Collection Instrument

The data collection instrument was divided into two main sections. Part I surveyed teacher and student perceptions about instructional methods for promoting active student involvement. Teachers and students were asked to respond to each statement using a Likert Scale of "1" to "6" with "1" representing strong agreement and "6" representing strong disagreement. The variables were: (a) use of technology, (b) classroom management, (c) communication patterns, and (d) teaching habits.

Part II collected demographic information. The variables for the teachers were: (a) teaching experience in a traditional classroom, (b) teaching experience in an interactive television classroom, (c) time of class, and (d) type of system used. The variables for the students were: (a) year in school, (b) type of student, (c) experience with interactive television courses, (d) subject of the course, (e) grade expected in the class, (f) time of class, (g) future plans, and (h) who influenced them to take the course.

Development of the Instrument

The questionnaire was developed using questions from surveys of other interactive instructional television courses identified during the review of the literature. The initial questionnaire was evaluated by a group of people experienced with either distance education or research. This group included: (a) Dr. Sharon Smaldino, Associate Professor at the University of Northern Iowa, (b) Dr. Robert Hardman, Professor of Education and the Director of the Center for Educational Technology at the University of Northern Iowa, (c) Mr. Terry Goro, Coordinator of Instructional Technology Services at the Center for Educational Technology--University of Northern Iowa, (d) Dr. Carmen Montecinos, Assistant Professor at the University of Northern Iowa, and (e) Ms. Chris Sorensen, Evaluation Specialist at the Research Institute for Studies in Education--Iowa State University. The questionnaire was adapted according to their suggestions.

Administration of Data Collection Instrument

The questionnaire was sent to the teachers and to the classroom facilitators at the remote sites. A cover letter gave directions so that the questionnaire was administered under nearly identical conditions at all of the locations. The students were informed of the fact that the subjects couldn't be identified and that they could choose not to participate in the study. Time was given in class to complete the questionnaire. They were then collected by the teachers and classroom facilitators and returned to the researcher.

Conclusions

Demographics

The results from this study indicate the majority of teachers and students were experiencing interactive instructional television for the very first time. This agrees with the statements in Willis (1992). A new environment for learning has just been developed--one which is unfamiliar to both the teacher and student. Teachers need to create an environment that encourages students to become involved in the learning process.

Technology

This section of the questionnaire dealt with teacher and student perceptions about the role technology plays in enhancing participation in a distance education class.

The data collected suggests that both teachers and students hold favorable attitudes concerning technology use as a means to enhance student involvement in a distance education class. In fact, only two percent of all of the students surveyed disagreed with the statement that technology use by students encouraged participation in class. This corresponds with suggestions from both Rezabek (1988) and Willis (1992). Teachers need to be comfortable with using technology. Willis (1992) went on further to state that communication between teachers and students will be inhibited until they become accustomed to using the technical delivery system. If communication is inhibited, participation in class will also be inhibited.

Classroom

This section of the questionnaire dealt with three aspects of classroom management: (a) keeping students on task, (b) having a well organized class, and (c) clearly identifying teacher expectations of students.

Two-thirds of the teachers and 80% of the students were in agreement with the statement that keeping students on task enhanced student participation in class. When comparing the attitudes of the origination and remote site students, it is interesting to note that while 12% of the origination site students disagreed with the statement, 26% of the remote site students disagreed with the statement. This could be caused by remote site students appreciating the less restrictive learning environment that may occur when the teacher is not physically present in the classroom

Both teachers and students were in agreement that well organized classes and clear expectations of student behavior were important. In fact, only four percent of students held unfavorable attitudes towards the importance of well organized classes. These results support characteristics of effective teachers in traditional classrooms identified by Borich (1992), Brophy (1992), Heroman (1990), and Porter and Brophy (1988). These results also agree with suggestions made by Office of Technology Assessment (1989) and Rezabek (1988) that teachers in a distance education class use the same educational techniques that had been proven effective in the traditional classroom.

Communication

The statements in this section of the questionnaire dealt with communication patterns found in distance education classrooms that promote active student participation in class.

All of the teachers and students surveyed agreed that a teacher who is enthusiastic and demonstrates a sense of humor at appropriate times enhanced student involvement in the class. This agrees with characteristics of effective teachers identified by Langlois and Zales (1992) and Weaver II (1993). The results also agree with the conclusions concerning important teleteaching behaviors identified by Chung (1991), Egan (1991), Hardman (1993), Massoumian (1989), and Office of Technology Assessment (1989).

Teachers and students agreed that it was important for a teacher to create and maintain eye contact with students while talking to them. This agrees with effective actions identified by Egan (1991), Hardman (1993), and Rezabek (1988). Teachers and students were also in agreement that it was important for teachers to know and use student names when talking to them. This agrees with conclusions drawn by Office of Technology Assessment (1989) and Willis (1992). However, it was not considered as important for students to identify themselves when speaking. In fact, only 24% of all students considered this important. This suggests that possibly as the teachers and students get to know each other better, they learn to recognize each other's voices and formal identification is not necessary. This contradicts a suggestion offered in Hardman (1993) that students should identify themselves when speaking.

The teachers and the majority of students held favorable attitudes concerning the statement that timely feedback from the teacher was important. Only 20% of origination and remote site students disagreed with the statement. This supports conclusions found in Chung (1991). The response also agrees with characteristics of effective teachers in traditional classrooms identified by Borich (1992) and Heroman (1990) as well as techniques for promoting participation identified by Morgenstern (1992) and Smaldino (1992).

Nearly all of the teachers and students believed that it was important that there be opportunities to ask questions and communicate with the teacher as well as other students during the class time. This agrees with conclusions drawn by Massoumian .(1989), Office of Technology Assessment (1989), Rezabek (1988), and Willis (1992).

Teaching

This section of the questionnaire dealt with specific teaching habits for promoting active student involvement within a distance education classroom.

The teachers and the majority of the students agreed that it was important to begin each class with a review of the previous class session. Only 25% of the students disagreed with this statement. However, the teachers and students felt it was more important that the objective of each class be identified at the start of class. This agrees with suggestions found in Borich (1992), Hardman (1993), and Smaldino (1992) of methods to promote interaction in a classroom. It also agrees with characteristics of effective teachers identified Borich (1992) and Smaldino (1992).

All of the teachers and 89% of the students felt it was important for teachers to summarize information before moving on to new concepts. This result supports conclusions drawn in Chung (1991).

All of the teachers and the majority of the students held favorable attitudes towards the statements that the teachers should instruct the class at an appropriate level of difficulty as well as use appropriate pacing during instruction. Only 10% of the students disagreed with these statement. These results support suggestions found in Egan (1991), Rezabek (1988), and Willis (1992).

It was interesting to note that the majority of teachers and students agreed with the statement that utilizing large group instruction promoted student participation in a distance education class. This contradicts suggestions offered by Hardman (1993) for teaching styles that promote interaction.

All of the teachers as well as 84% of the students felt that it was important for the teachers to vary learning activities within a single class. It was interesting to note that remote site students felt more strongly about this statement than did the origination site students. In addition to this, all the teachers and students felt it was important for the teacher to encourage student participation in class activities. The results from both statements agree with suggestions for effective teaching in a distance education classroom found in Hardman (1993), Klinger and Connet (1992), Office of Technology Assessment (1989), and Rezabek (1988). These results also agree with suggestions for effective teaching habits in a traditional classrooms found in Borich (1992), Heroman (1990), and Morgenstern (1992).

All of the teachers and 96% of the students agreed that when teachers use a variety of visual materials, involvement in class in enhanced. This agrees with statements found in Hardman (1993), Office of Technology Assessment (1989), Rezabek (1988), and Willis (1992). It was interesting to note that students held more favorable attitudes than teachers towards the importance of providing handouts for each class. The results, however, support suggestions found in Egan (1991) and Hardman (1993).

Seventy-one percent of the students and all of the teachers felt it was important to allow time in class to work on assignments. This agrees with suggestions for effective teaching in the traditional classroom found in Hardman (1993) and Smaldino (1992). It was interesting to note that remote site students felt more strongly about this than origination site students. This suggests that they may desire the opportunity to get assistance from the teacher, if necessary, on their assignments. Getting assistance from the teacher outside of class time may be difficult if not impossible.

Recommendations

The results of this study suggest that high school students' perceptions of effective instructional methods for promoting active student involvement within the interactive instructional television classroom agree with their teachers' perceptions of effective instructional methods. The results also indicate that many of the teachers are knowledgeable about teaching practices in the distance education classroom that have been identified as effective in the traditional classroom.

A comment from a origination site student stated that students won't participate in class until they feel comfortable doing so. A remote site student offered a solution to this problem. The student suggested that the first class should be organized to allow the kids to become acquainted with each other so that they won't be afraid to offer comments to one another. If this feeling of comfort were established early on in the class, one barrier to interaction would be removed.

Another comment from a remote site student stated that participation in class would be enhanced if the teacher attempted to involve all sites equally. This lessens the feeling of social isolation evident in some remote sites.

This study only asked if teachers and students felt that the practices identified in the questionnaire would be effective in promoting interaction in the distance education classroom. The study did not ask if the teachers actually utilized the teaching practices identified. Another recommendation would be that teachers incorporate these teaching practices be incorporated into their distance education classes if they are not already present.

This is a pilot study concerning teacher and student perceptions. It does not address factors to affect the development of those perceptions. Further research to identify these factors is recommended. Areas to consider include how the school atmosphere as well as how the size of the class affects the communication patterns of teachers and students. Further research should include interviews with teachers and students to aid in identifying effective instructional methods for promoting active student involvement in a distance education class.

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Teaching Science at a Distance: The Teacher's Perspective

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Introduction

In the past century, the world has witnessed major advances in the development of communications technology. The impact of these developments has been dramatic in the field of education. Innovations in communications technology have led to the creation of distance learning programs at all levels of schooling. Jefferson and Moore (1990) report that many states with rural districts, lacking properly trained teachers in subjects such as mathematics and science, look to distance education systems as a way to fill these voids.

While this new technology offers vast potential it also brings with it a host of considerations for the teachers who use it. Stern (1987) points out that the availability of distance learning technology requires that teachers have an awareness of necessary skills to reach the distant learner. Teachers using distance education technology face a variety of challenges as they try to adapt their teaching styles to a framework compatible with such an environment.

Past research studies indicate that the success or failure of a telecourse depends most heavily on the quality of the instructor (Chung, 1991). Teachers in all settings share similar responsibilities for planning, preparation, delivering instruction, and assessing students. However, as Carl (1991) points out, some educators have reservations that distance education courses would add significantly to a teacher's already heavy workload. This results from larger class enrollments, the need to plan well in advance, and other considerations related to this mode of instruction.

Research done on the comparisons between traditional classroom instruction and distance courses finds no significant difference in student achievement in either setting (Chung, 1991). Closer examination reveals that few of these studies deal specifically with science courses which are, by their nature, different from other subjects. In particular, teachers of science face perhaps the most unique obstacles as they try to incorporate the laboratory experience into their distance education courses (Mugridge, 1991).

In order for distance education to be accepted as a viable method of instruction, a concerted effort must be made to address the concerns and needs expressed by the teachers using the technology.

Statement of the Problem

The primary aim of this study was to amass information concerning the impact of distance education teaching on science teachers who use it as a means of delivering instruction. In any distance telecourse, the teacher plays a pivotal role in determining how effectively the technology is used and whether or not it results in successful student outcomes. Science teachers encounter additional responsibilities when compared to their teaching colleagues in other subjects considering the specialized facilities and laboratory equipment that are often utilized in science courses. This factor could conceivably make distance education science the most challenging subject to be taught in this setting. Thus, science teachers' attitudes and perceptions toward the use of distance education technology may be the most tell-tale in regard to how widespread its acceptance is within the educational community.

It is this rationale on which the present study was based. More specifically, the purposes of this study were to determine the effectiveness of any training that the teachers received relating to the technology before using it, and the types of ongoing support they received while teaching these courses. Also of major interest in this study were the comparisons teachers made between their distance science courses and their traditional ones in regard to pedagogical considerations, student outcomes, and human interaction aspects. Finally, this study intended to gather data on science teachers' perceptions of the viability of distance education technology as a means of delivering science instruction relative to its potential benefits and limitations.

Design and Methodology

The research design used in this qualitative study consisted of five individual case studies of distance education science teachers in the state of Iowa. The conceptual framework utilized was based on the perceptions of these teachers with regard to their experiences as distance educators in science. With the exception of one respondent, the data collection process consisted primarily of in-depth interviews conducted via telephone. While face-to-face interviewing would have been preferred, the considerable distances separating the researchers and respondents made this option unrealistic. The opportunity for participant observation of actual distance science classes in progress was similarly precluded because of the distances involved. As a result, only one teacher, who was located nearby, was observed.

The researchers carried out each science teacher interview using an interview schedule that was developed for the purposes of this study. In all, five teachers were asked about their experiences surrounding the use of distance education technology to deliver science instruction. The individual teachers selected were randomly chosen from a list of potential candidates who were currently teaching a distance science course. This list was compiled by contacting the Regional Coordinators of the Iowa Distance Education Alliance, who were asked to provide the names of any such individuals in their area. The teachers randomly selected from the list were contacted by the researchers, and their interviews were audio taped and later transcribed. Their collective responses were coded into categories that emerged from the data they provided, and the analysis of results was carried out using Glasser and Strauss' constant comparative method (Glasser and Strauss, 1967). The data for this study was collected between September 1993 and September 1994.

Results

The researchers asked respondents to describe their experiences related to teaching a science course over a distance education system. The respondents shared their thoughts on topics such as the training they had received concerning the use of the technology, and any additional training they felt would have been beneficial. Regarding actual teaching considerations, the respondents provided extensive information on the comparability of distance education versus traditional classroom science instruction on a wide range of issues. Data pertaining to the technical aspects of the technology, and support personnel available to them were also gathered. Finally, the respondents offered their opinions on the viability of distance education technology for delivering science instruction.

The following sections summarize the findings of this study with each set of propositions being grounded in the data garnered from these five case studies. Quotations are occasionally paraphrased so as to avoid identifying a particular respondent and to insure the confidentiality of all responses gathered in the study. The quotations which are included are representative of the responses given on the stated topic.

Teacher Background

The respondents in the interview pool were an experienced group of teachers, averaging 17.4 years of teaching experience, with 2.8 of those years being in a distance education setting. Two-way interactive teaching experiences ranged from two weeks to eight years. The classes were being broadcast to an average of four remote sites. The number of students involved in the classes, however, varied dramatically, from a low of four remote students to a high of 45 students at a distance. Most teachers were teaching on the system voluntarily, although two-way interactive teaching is not necessarily their preferred mode of instruction. Some courses were only being offered in a distance education setting, which meant that if a teacher wanted to teach that particular class, he or she would have to 'volunteer' to teach it at a distance. One respondent had a small monetary incentive to teach via the system.

The types of systems being used by the respondents varied. Some taught on a fiber-optic system and some teach on microwave systems. Both of these systems however, are live, two-way, and interactive. In all cases, students can speak to the instructor by depressing a button on their microphone. Teachers can control the camera shot, zoom in and out, use an overhead and other audio-visual equipment. In some cases the camera angles are able to be changed but in most cases the camera is fixed. Our respondents have taught a variety of classes in the distance education setting.

Inservice and Preservice Components

Most of the respondents had engaged in some sort of training activities prior to teaching in a distance education setting. While the perceived effectiveness of the inservice varied, all felt that the opportunity to try the system before teaching was very important. Some respondents participated in a preservice component put on by their schools while others had a one-on-one introduction to the system. Being able to practice teaching while operating the system seemed to be the most valuable aspect.

Respondents were asked to describe the ideal inservice workshop for teachers new to the distance education arena. All of our respondents said the inclusion of a hands-on, practice teaching component would be critical. In addition to practice, the workshop ought to incorporate a 'show and tell' of what the system can do while also addressing more mundane daily considerations.

> *I would show how you can demonstrate this and demonstrate that, use the computer, use models, and go back and forth and talk about some of my own experiences on it. Sort of have an experienced person talk to the folks about it and then have people at various sites and have them go at it and do a practice lesson on it. I think an inservice would involve some sort of discussion of the details and that's one of the things that's really important - the details- make sure you work out this problem or that problem.*

The other component of the ideal workshop, the nuts and bolts of teaching at a distance, address questions like these: How large to write so all students can see?; What colors to wear so that you don't melt into the background?; How much zoom is good?; "How do you turn it on?; What do you do if the system's not on when you want it to be on?; How do you plug in the microphone?; What volume do you use?; How do you go from one test site to another?" The difficulties that are likely to arise while teaching at a distance should also be discussed. "How can we encourage discussion to get participation of the people enrolled in these courses?" Issues dealing with site monitors, handing back of student work, and test taking might also be part of the discussion.

Teachers' Attitudes and Perceptions Toward Using Distance Education Technology

There is a clear diversity of teachers' attitudes and perceptions related to distance learning technology prior to their actually teaching a course using it. Some respondents described their initial feelings about distance science teaching as ranging from mild apprehension and anxiety to "fear of looking like a fool," and "dislike of the idea." Yet, others were less intimidated to the point of even being excited about the opportunity to teach in this setting. One respondent who had previously taught science courses using a videotaping procedure "wanted to be on [the new, live system] because of the improvement that it would make in the delivery of the course."

Most respondents expressed initial concerns about factors such as establishing rapport with students at the distant sites, and their ability to utilize the same teaching strategies common in their traditional classrooms. Of particular importance to these five teachers was the likelihood of being able to develop the "personal aspects" of classroom dynamics such as "reading students' faces" to look for signs of understanding or confusion.

Many respondents worried about how they would make their distance science course as "informal" as they liked their classes to be. This issue was particularly relevant to being able to perform science demonstrations. A respondent stated that

> *It seems like having a demonstration would kind of shift the focus off the instructor for a while and onto the phenomena...I feared that if the only technique that I had was my wit and my creative discussion abilities, then I might fall short.*

Despite the lack of uniformity in the teachers' initial feelings about having to teach science to distant learners, all of them expressed similar thoughts about it after having done actual distance teaching.

> *It is much like being a beginning teacher the first time you go in [the classroom] is the scariest moment. Once you've succeeded after the first class, you take a deep breath and say 'Oh, we made it though that one,' and the next time it's a little easier.*

All of the respondents indicated that they felt more confident and comfortable teaching on the system once they had done it. They reported that once their initial feelings of nervousness were overcome that they became more concerned with "having a good lesson planned out," and "having good questions to ask." One respondent summarized this by saying that "the first ten minutes felt awkward, then the camera and technology became secondary."

Support Personnel

The role that support personnel play is key to a well run distance education experience. Each campus has a secretary that is assigned as the support person and this person is to take in papers, hand out papers, move them by mail back and forth. They also will generally monitor or arrange to have examinations monitored.

> *The person in charge has a secretary who will take care of mailing materials out and it's not real smooth in that that person is located in another building. Since I am one who likes to give assignments and grade homework, I have a lot of papers incoming and outgoing. I guess that is one kind of clumsy part of this arrangement.*

The papers collected by this support person must be mailed or driven from remote sites to the instructor. Students often complain. A respondent told us "I got criticism today from a student asking 'where is my homework?' and I told the group they are in the mail."

Teachers giving daily assignments continually deal with this time delay. Reviewing assignments in class is problematic because students at the home site have their test/homework in front of them while the students at remote sites will not get theirs for another week.

The support person also makes sure that tests are monitored. This is a concern for instructors. Since it is difficult to see the remote sites well there must be a great deal of trust in testing situations and the level of trust is not always there.

> *The idea of how do we give a test at one place as well as the other places at once and have the trust of the students that they won't cheat and things like that and be able to get the results back - the test back - so they can be corrected... We're still trying to work out the logistics of getting this done.*

> *I worry about the homework aspect and to some extent the testing. There's been some difference in how tightly the monitors monitor test taking. I've heard rumors that at some sites people get by with cheating on tests.*

Another aspect of having students at a distance is the difficulty of giving spontaneous quizzes or handouts. In order to get material to remote sites, the instructors must send papers in advance through the site monitors. While faxing is a possibility, the fax machines are often not secure and not in the same locale as the site monitor. As a practice, faxing is not encouraged.

In addition to site monitors, our respondents had access to technical support. This included technicians connecting computers into the system, work study students filming class, and technology departments answering questions about the system.

Technical Aspects of Teaching at a Distance

The general consensus of the respondents was that you will make mistakes when teaching in a distance education setting, and the students will let you know. "The students will tell me if they can't hear and I look for the button." The technical aspects of teaching at a distance--the technology, the buttons, the microphones--are just a few more things to think about and worry about.

> *My fears were confirmed as far as the button pushing and making sure the camera is on the right place at the right time. I've made some mistakes and what I learned,--and they warned us about this at the orientation, that we will make mistakes-- is that the students will let you know. They'll say--we can't see what you're doing--or whatever. I feared it would happen and it did.*

> *Once in awhile you'll start talking about a topic and you will forget the camera's focusing on the overhead only and I can imagine the people at the other site probably are pretty sick of looking at a blank overhead.*

> *There is an added dimension to the teaching because you have to push buttons and look at some people on a television screen. And that is a little different from a regular classroom. I compare it in many ways to the difference between driving a car with an automatic transmission to driving a car with a stick. How the stick is an added dimension of having to shift here and there--a small change while still doing all the things that you did before. Teaching on the [system] is somewhat similar in that there is an added dimension of having to push buttons on a touch screen and look at the camera*

> *and the TV monitor while still having to do all the things that you did before. It took a few weeks to get used to that but once I was.... I didn't have to be thinking about it consciously.*

Teaching at a distance does add new responsibilities to the teacher. The respondents tend to agree that mastering the technology gets easier with time. While the technology has made some aspects of teaching more complicated, it has made others easier. The zoom capability of the camera allows models to be seen more easily. Video cassette recordings and computers are easier to use in the lecture. "Just plug it into the system and you're off and running." Some of the downsides of this technological classroom include "being tied to the microphone," having to stay in one spot so that buttons and cameras can be controlled. While models are easier to show, demonstrations are more difficult. The rooms are "not science rooms. They're just blackboards and desks or tables." Writing on the overhead must be larger than normal in order to be seen. As a result, not as much information can be transmitted at a time. Remote site students' faces, on the other hand, are smaller and more difficult to see. Students need to depress the buttons on their microphones in order to be heard.

> "They have to actually hold down the microphone in order for me to hear them. My students at [the origination site], it's easy for them to talk to me and if they forget to push down the microphone then the remote students are saying 'What did you say?' They can hear me talking but they may not be able to hear the other students."

A concern voiced by many respondents is that students are reluctant to speak because of the button pushing.

Comparisons of Distance Education Classes Versus Traditional Science Classes Regarding Teaching

The science courses taught by the teachers in this study were primarily lecture-based with emphasis placed on classroom discussions. These classes were described as seldom having hands-on experiences associated with them. In some cases students were required to take a separate lab course in conjunction with the distance science course. There was little discrepancy in the way these teachers taught in their distance course in comparison with their traditional science classes. When respondents were asked to compare their courses typical responses included, "I would say they are very similar, lecture based with class discussion." Respondents who did use demonstrations or hands-on materials stated that they "had to think about them in terms of how they would appear on the [technology] system."

One aspect of teaching that was referred to often was planning and preparation time. The respondents indicated that prior planning was essential in the distance courses, more so than in the traditional ones. None of them, however, complained of not having the necessary planning time available.

The most important planning consideration mentioned by the respondents was that of "preparing class materials to be mailed out to the remote sites," and "planning how to deal with the lag time between receiving and returning student materials." Other respondents stated that the majority of their out of class time related to the distance science course was spent mostly on grading papers.

A key comparison that was identified by the respondents was that classroom interaction with students in the distance courses required additional effort on the part of the teacher to insure that it occurred. Frequently this involved the use of questioning to initiate discussion.

> *I usually stop every so often during the lecture [in my distance class] and ask each specific site if they have any questions. I can make sure that if they are a little shy about asking questions that they will do it.*

Another respondent used a similar approach urging students to "share experiences they have had related to the topic of discussion with the class." In any case, the need to make an effort to ask more questions in the distance science classes was indicated by all respondents. One respondent had students at all the sites "wave to each other at the start of class so they kind of feel like they are together a little."

One area of central importance in comparing distance teaching to traditional teaching is the impact on a teacher's pedagogical approach. Teachers develop a set of instructional strategies that are effective for them in instructing students that produce the desired outcomes in student learning they seek. Respondents indicated that there are modifications that had to be made to accommodate their teaching science at a distance.

These ranged from having to "sit at the front of the room and not be able to move around because of the microphone" to having to "memorize the material to be presented the first day so I could do it without notes...and concentrate on the mechanics of the system." It became clear from the data that respondents felt that they had to make few drastic changes in their pedagogical style to teach in the distance classroom beyond the ones described here. Also important was the fact that none of the respondents felt that their experiences teaching science at a distance had any effect on the way they taught their traditional science classes.

Respondents were asked to describe the goals that they had for students in their science classes, both in the traditional classroom and in the distance class. Typical goals for these students included being able to make applications of the concepts and content understanding. Despite some variations in the actual goals deemed important by these teachers, respondents generally stated that "they would be exactly the same in both classes" and that "they are basically the same with little difference between the objectives I have for the TV class and the regular class."

A final comparison of distance science teaching with traditional teaching dealt with assessing student achievement and the attainment of the goals the teachers had for their students. The majority of respondents felt that the best measure of student learning was done through testing, homework, and quizzes. Also, respondents stated that regular attendance and class participation were sometimes used to evaluate students. The tests used by these teachers were described as primarily multiple choice, true/false, matching, and essay type examinations. The respondents indicated that there was little difference in the assessment of students in either setting.

Student Aspects of the System

A major concern of teaching at a distance is whether or not students can learn at a distance. Informal studies done by our respondents, and more formal studies done by their schools, would indicate that students in both settings do equally well. The learning experience for both, though, may not be the same. Since the teacher and the student are not in the same location the level of control and interaction is changed. Respondents wanted all students to interact and they had mixed results.

> *I keep thinking, how can I get the people at the other sites to be more interactive. How can I make sure that they aren't being bored to death and that they're not going to fall asleep and I may not even see it if they don't all over.... I guess some other thing that seems to pop up too is that students don't really want to use the buttons on the microphones. They feel kind of awkward.*

> *I think as far as student interaction, it's very similar--the two (live versus remote). I call on students, I ask for responses, they ask me questions, and I think there's as much student interaction.*

> *The discussion part of the class was hampered a bit because of the TV--students are reluctant to push the button on their microphone to speak. You would have to ask them why they are reluctant to do it. I think in a small classroom setting it is easier to just say a few words that come to you as opposed to [being on the system] where you have to lean forward, push on a microphone, look out and be aware that there is a camera watching you. It makes people more conscious of what they are doing perhaps. This is something they shared with me at the end of the course.*

> *The people at the off sites, it's hard to get them to interact much.*

> *I think there would be an inverse relationship. The smaller the class, the greater the participation that you get.*

Having students at a distance removes the likelihood of one-on-one interactions. It takes longer to get to know the students' names. Students need to take more responsibility for their own learning because the instructor is not in the same room. As a result, students at different sites get different experiences.

> *The people in [the origination classroom] felt that the course they got was different than the class that some of the students at the remote sites got because they got to see me in person and hear me and pick up on things that people at the other sites did not.*

In spite of this difference, students seemed to have comparable success rates.

> *We've done some studies, at least the coordinator of the TV courses has, and published results of the studies. He's found the grade point average for courses students have taken on TV is no lower than the grade point for people who take it live. I haven't done a study myself, in my courses. Just from a casual observation of success, I find that to be the case. It's no better, it's probably not worse than the live instruction.*

Another factor in student success is 'the type of student' enrolled in the course. Many of the students taught by our respondents were non-science majors or students returning to school. These students, it was reported, tend to have more difficulty with science classes regardless of the mode of instruction. No difference in performance was noted.

Teachers' Thoughts Concerning Distance Education as a Medium of Instruction

When considering their impressions of distance education technology being used to deliver science instruction, respondents statements fell into three main classifications. These included the perceived benefits and limitations of the technology, modifications that could be made to improve the quality of the experience, and finally, the overall viability of the technology for teaching science.

The limitations most often cited by respondents dealt with their "inability to walk around the classroom to make things seem less formal" and the difficulty in "trying to see students facial expressions on camera." The respondents stated that these problems caused the distance classes to be less personable. Respondents identified other limitations of the technology as being "the slowness of exchanging materials between sites." The most often cited limitation, which was a major concern of several respondents, was the lack of necessary scientific lab equipment and facilities in the distance education classrooms. Often, these distance classrooms were located at some distance from the science department.

> *You don't get as good instruction as you would if you had the class scheduled in the science building... where the instructor can quickly get out apparatus and show you live phenomena.*

The respondents in this study did, however, also see potential benefits of the distance education technology for teaching science. They cited factors such as expanded course offerings, improved enrollments in courses, and reducing the cost of hiring numerous instructors for only a few students at each site. A respondent commented that "the technology facilitates people taking courses from remote locations that might not otherwise be able to do so." Respondents saw potential benefit in the ability to use the technology to zoom in on small objects presented in class that normally would not be seen very clearly in a regular classroom, and also the potential to interface with computer technology. In terms of personal factors, one respondent saw the opportunity to teach science via distance education technology as "a benefit for me in the future because any place I go for employment will look and say that 'This person has experience in something that is the wave of the future.'"

A second classification of responses centered on suggested modifications that could be made in distance classrooms to better accommodate science teaching. Respondents felt that having a classroom with appropriate facilities for science was crucial so that demonstrations and hands-on activities could be more adequately performed. Some of these suggestions included "having portable lab benches and movable cameras," and "having the remote cameras zoom in on students faces when they key their microphone."

> *A lab table with a sink is what you would need. You have to be able to move around the room with a camera. The cameras now are stationary.*

The last classification of responses, and arguably the most important one, concerned the teachers thoughts on the overall viability of distance education technology as a means of delivering science instruction. There was no clear pattern of agreement in this area based on the statements made by the respondents. While most respondents believed the technology was indeed a viable alternative to traditional teaching, many felt that this was only true under certain circumstances. For example, respondents felt that it was fine for basic introductory level science classes, but more advanced courses would "require a [significant] hands-on component that you won't be able to do."

> *The quality of instruction would be the same in a distance class as in a traditional class as long as you have a teacher who understands how to operate the system.*

The respondents voiced concern over possible negative impacts of the technology such as "reducing the number of teachers hired by schools," and "taping classes so that they could be used again in the future" without hiring an instructor. Another respondent was unsure of the actual cost-effectiveness of operating the technology as opposed to just hiring instructors to teach the course in a traditional classroom.

The following is how a respondent summarized his feeling about the viability of distance education technology for teaching science .

> *Distance education isn't going to solve anything that has to do with hands-on teaching. I think if it's known where the line is drawn, where distance education is viable and where it's not, I think it will be a very useful system. I think you have to know that there are some classes that are not going to work. Once that's recognized, then I think it will work out fine.*

Discussion

The primary aim of this study was to amass information concerning the impact of distance education science teaching on science teachers who use it as a means of delivering instruction. Most teachers initially felt a considerable level of anxiety about teaching a distance education course. This concern seemed to be the overriding issue for them at the time. Some respondents went to the extreme of memorizing entire class lectures so that all attention could be given to 'button pushing.' With time and experience, however, these fears diminished. This resulted in more attention being focused on the lesson. It appears that this was the point at which the system's limitations were discovered. Since students were not in the same room as the instructor it was difficult to get to know the students and monitor their level of course mastery. One way to get around this was to teach from remote sites, or go to student laboratory sessions. This was not always feasible, given scheduling problems and the distances between sites. Another limitation of the system was the lack of mobility experienced by the teachers, as dictated by the fixed location of the controls. This led to a more formal class climate described as undesirable by our respondents.

Beyond the issues of formality and not knowing the students, a greater concern for science teachers is the ability to perform demonstrations and hands-on activities during a lesson. The distance education setting, as it is currently exists, prohibits this. The classrooms lack sinks, lab benches, and exhaust hoods. This presents problems for any science class which is not lecture/discussion oriented. These are problems which can be overcome. Suggestions offered include building a specialized distance science room, or having portable lab benches and portable cameras. Since science classes require the most specialized equipment and arrangement it only makes sense to have the origination site be in a science room. All other classes could easily be taught in a science room but science teaching is not as easily adapted.

The last major concern voiced by all respondents was that of materials handling. This refers to the paper shuffle which takes place for any assignment, test, or quiz. This was cited as a source of frustration for all parties involved. Students and faculty both complained about the current delivery method. This could be overcome by using fax machines, electronic mail, or the Internet.

Conclusion

Many of the issues raised here can serve as a useful hypothesis to be tested in future studies. How should distance education be implemented into preservice teacher programs? What are the most effective inservice experiences? Would the presence of laboratory facilities result in changes to teaching approach/style? How effective are alternate methods of the handling materials between sites? Examining the attitudes and perceptions of the students of distance education science teachers might be of particular interest. This is especially true when comparing students in the origination site classroom to students at remote sites. This would provide a more comprehensive understanding of the dynamic interaction that exists between instructor and students who are separated by distance. Two-way, interactive telecourses provide opportunities for study that may not otherwise exist. It offers lifelong learning opportunities to the community at large and thus serves an important role in the educational sector.

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An Assessment of Iowa Secondary Vocational Teachers' Attitudes Toward Using Interactive Distance Education Strategies to Support Competency-Based Curriculum Reform Efforts

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Introduction

Vocational Education is strongly influenced by Federal and State legislation mandating parameters and content, including competency-based applied learning that contributes to an individual's academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, and the occupation-specific skills. Iowa legislation, (Senate File 449) effective July 1992, provides for equal access to a diversity of quality programs by specifying program characteristics, minimum requirements, and competencies. Instructional approaches include supervised work-study/cooperative education, in-class/laboratory instruction, correspondence education and, competency-based performance testing. Distance education methodology is relatively unknown as an approach to providing vocational courses. It is anticipated that successful delivery depends upon a number of factors.

The purpose of this study was to assess the attitudes of Iowa vocational teachers toward using interactive distance education strategies to support the competency based curriculum reform efforts mandated by the Federal and Iowa Departments of Education. Specific objectives of the study were to identify:

1. Teacher attitudes regarding the use of distance education instruction in local vocational programs.

2. Perceived advantages and disadvantages in using distance education instruction.

3. Specific courses and enrichment experiences provided by distance education instruction.

4. The desirability of teaching specified competencies in the vocational education core curriculum via distance education. The core curriculum competencies are: leadership; job getting, keeping; and entrepreneurship.

Results may be used by vocational educators to establish priorities related to distance education. Further research in this area will be influenced by teacher acceptance and use of the Iowa Communications Network (ICN).

Significance and Need for Study

Vocational Education is strongly influenced by Federal and State legislation mandating parameters and content. The federal mission of Vocational Education as defined by Carl D. Perkins Vocational and Applied Technology Act of 1990 is as follows: "Organized educational programs offering a sequence of courses which are directly related to the preparation of individuals in paid or unpaid employment in current or emerging occupations requiring other than a baccalaureate or advanced degree." Such programs shall include competency based applied learning that contributes to an individual's academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, and occupation-specific skills necessary for economic independence as a productive and contributing member of society.

Iowa legislation, (Senate File 449) effective July 1992, provides for equal access to a diversity of quality programs by specifying program characteristics, minimum requirements, competencies, evaluation, regional planning, composition, duties of regional and merged area boards, and five-year planning. Further, Iowa requires vocational education programs for 7th and 8th grade students in addition to programs designed for high school and adult learners. Although vocational education programs have included programming for handicapped/special needs students since the mid-70's, an intense effort is now underway to assess the inclusion of courses designed for handicapped students at community colleges and area vocational-technical schools.

Vocational Education discipline titles vary from state to state. However, they are commonly referred to as agricultural education, business education, home economics/FCS (consumer and homemaking, and occupational), distributive education, technical education and, trade and industrial education. Instructional approaches include supervised work-study/cooperative education, in-class/laboratory instruction, correspondence education and, competency-based performance testing. Instructional settings vary to include the comprehensive secondary school, alternative high schools, home study, and industrial or community/business work sites.

Vocational educators historically maintained differences from general educators because of the need to focus on vocational and avocational skill acquisition, and manipulative skills that are immediately relevant to learners. That is, concrete supersedes abstract learning in most situations and hands-on applied learning is the preferred model. Typically, vocational teachers not only undergo preservice academic experiences, but also have work experience to support the discipline. Teacher education programs in vocational education encourage this type of student experiential base.

Distance education methodology is relatively unknown as an approach to providing vocational courses. It is anticipated that successful delivery depends upon a number of factors. These include the adaptability of the technology to the aforementioned teaching/learning styles and overcoming perceived philosophical and physical barriers on the part of vocational teachers. To this end, the challenge is to identify effective and successful strategies or "a synthesis of best practices." Once these strategies are clarified, appropriate vocational curriculum methodologies can be written. The basic question that needs to be answered is: Do teachers perceive that distance education technologies can be used as a practical means to support the implementation of the Standards for Vocational Education in Iowa?

This study addressed three of the four identified priority areas listed in the Teacher Education Alliance request for research grants. Specifically, it addresses distance education in Iowa, the Iowa Communications Network, and the Iowa Distance Education Allian[illegible]--Iowa's Star School Project.

Methodology

This study was descriptive in nature, and involved the use of a mailed questionnaire. The questionnaire was developed by the researchers after a review of the literature. The questionnaire was reviewed by a panel of experts and pilot tested by university graduate students. The project was reviewed and approved by the Iowa State University Committee on the Use of Human Subjects.

The population for the study consisted of all secondary vocational teachers in Iowa as defined by the Iowa Department of Education in March, 1994. There were 2,420 vocational teachers at the secondary level from which a stratified sample of 12.4% was drawn from each of the discipline areas (Agriculture, Business, Home Economics, Industrial, and Marketing). A total of 300 teachers was selected: 29 agricultural education, 14 marketing education, 64 home economics education, 90 industrial education, and 104 business/office education.

The questionnaire contained three parts. Part I assessed the level of knowledge and ability to use information regarding distance education teaching technology and curriculum reform. Part II explored respondents' interest in teaching a core curriculum to a cross-discipline vocational class. Specifically the three core concepts investigated were leadership, job getting/keeping, and entrepreneurship skills. Teachers were additionally asked if such a curriculum could be taught via the Teleteaching network in an interactive distance learning classroom with one or two remote sites. Part III requested information about the respondents' professional development and current professional responsibilities and assignments including distance education pedagogy. A final query looked at preferences regarding the acquisition and improvement of teachers' skills in Teleteaching.

Teachers responded to the questionnaire using General Purpose--NCS answer sheets. Data were read into a file at the Testing Center at Iowa State University. Data were analyzed using the SAS program. Frequencies for all responses and correlations for selected variables were computed.

Results

Profile of Respondents

A total of 67 usable responses were returned to the researchers. The majority of respondents (86.6%) reported that they had taught eleven or more years. The remaining teachers (14.4%) had 10 or less years of teaching experience. Most respondents (79.1%) taught at the high school level, followed by 19.4% middle school, 4.5% post-secondary, and 3.0% elementary. Almost two-thirds of the respondents (61.2%) indicated their highest level of formal education as a Bachelor's degree and about one-third (35.8%) held a Master's degree. One participant had a Ph.D. and one held a technical degree. All 67 respondents were certified as vocational teachers. At the time of study 62 (92.5%) were teaching vocational education subject matter. Three respondents reported that they were teaching subjects outside of vocational education, specifically one in science, one in foreign language, and one in literacy. Of those who were teaching vocational education subjects, there were: 8 (11.9%) in agricultural education, 7 (10.4%) in marketing education, 14 (20.8%) in business education, 18 (25.4%) in industrial education, and 22 (32.8%) in home economics education.

Three teachers (4.0%) had attended either a Star Schools Inservice Workshop or the Vocational Curriculum Institute and nine teachers (13%) had attended an inservice program on teleteaching at their local school. Approximately 87% of the respondents had not attended any formal presentation on teleteaching/distance education. Eleven teachers (16%) indicated they had acquired their level of knowledge from other teachers. When asked how they would prefer to learn about, and improve their skills in the teleteaching classroom the majority responded "through an inservice offering" and "from other teachers". About one-third indicated a preference for "technical assistance" followed by offerings from teacher education courses at the preservice and graduate levels (20% each). Teachers were not very interested in acquiring information and skills on their own from printed materials or video tape.

Curriculum Reform and Instructional Technology

Part I of the questionnaire explored teacher's knowledge of various curriculum reform issues and their ability and interest in making substantive changes. Three sections were designed. The first focused on curriculum reform issues that include distance education. The second section asked teachers to indicate their ability to perform their teaching role in an interactive distance education teaching environment. The third section requested teachers' interest in using prepared teleteaching lesson plans that require the use of community resources beyond the local site.

As indicated on Table 1, respondents were asked to indicate their level of knowledge relative to interactive teleteaching technology, federally mandated curriculum reform in vocational education, integrating academics and technology into vocational education, interactive teleteaching equipment, applications of distance education teleteaching to vocational education, and the creation of teleteaching plans for distance education. The response scale for their level of knowledge ranged from no knowledge (1) to extensive knowledge (5). Item means ranged from 1.69 to 3.21 and the mean average score for the section was 2.50. The item teachers felt they knew the least about was how to create a teleteaching plan for distance education (item mean 1.69). The item teachers believed they new the most about was federally mandated curriculum reform in vocational education (item mean 3.21). The second item teachers felt they knew something about was techniques for integrating academics and technology into vocational education (item mean 3.16).

Table 2 summarizes teachers' self-rated ability to perform their teaching role in an interactive distance education teaching environment. Six items were listed for teachers to consider with a response pattern ranging from (1) very inadequate ability to perform to (5) very adequate ability to perform the skill. Teachers rated themselves weakest in their ability to operate the equipment utilized in an interactive teleteaching classroom (item mean 2.37) and highest in their ability to speak clearly with adequate volume, and tone appropriate for teleteaching (item mean 3.58). With the exception of speaking ability, all other items were rated inadequate in their ability to perform. The mean average for these items was 2.75.

Items in Table 3 assess the teachers' interest in using pre-prepared teleteaching plans which require the use of resource persons from various settings, specifically, team teachers outside their discipline, team teachers within their discipline, guest speakers from business or industry, job interviews of students by professionals, and panels of potential employers to address students' questions. The response scale ranged from (1) absolutely yes to (5) absolutely no. The item means ranged from 1.87 to 2.36 and the mean average for the section was 2.04 indicating that there is a strong interest in using resource persons beyond the local setting as a part of interactive distance education teleteaching strategies.

Core Competencies in Traditional Classrooms

Core competencies found in the Iowa Department of Education vocational education program management guide were listed in Part II of the questionnaire. Teachers were asked to indicate their beliefs, from strongly believe (1) to strongly disbelieve (5), as to whether the core competencies could be taught across vocational disciplines as a core curriculum to a mixed

Table 1. Curriculum reform issues that include distance education

Statement	Mean[a]	Mean Average
Creating teleteaching plans for distance education	1.69	2.50
Applications of distance education teleteaching to voc. ed.	2.01	
Distance education interactive teleteaching technology	2.43	
Equipment used in interactive teleteaching	2.55	
Integrating academics and technology into voc. ed.	3.16	
Federally mandated curriculum reform in vocational ed.	3.21	

[a] 1=none, 2=very little, 3=some, 4=quite a bit, 5=extensive

Table 2. Ability to perform teaching role in interactive distance education

Statement	Mean[a]	Mean Average
Operate equipment utilized in interactive teleteaching	2.37	2.75
Handle the unexpected technical problems with ease	2.42	
Evaluate mini-lessons taught via teleteaching	2.55	
Employ variety of teaching strategies via teleteaching	2.75	
Attend to classroom management at separate sites	2.82	
Speak clearly with adequate volume and tone	3.58	

[a] 1=very inadequate, 2=inadequate, 3=unknown, 4=adequate, 5=very adequate

Table 3. Teachers interests in using prepared teleteaching lesson plans

Statement	Mean[a]	Mean Average
Panel of employers prepared to address student questions	1.87	2.04
Job interview of students by professionals	1.93	
Guest speaker from business or industry	1.99	
Team teacher within your discipline	2.01	
Team teacher outside your discipline	2.36	

[a] 1=absolutely yes, 2=probably yes, 3=not sure, 4=probably not, 5=absolutely not

Table 4. Leadership competencies in a traditional classroom

Statement	Mean[a]	Mean Average
		1.67
Follow directions	1.25	
Speak effectively	1.48	
Work with others	1.58	
Prioritize tasks	1.60	
Utilize time	1.64	
Define goals/strategies	1.66	
Organize an event	1.67	
Lead a discussion	1.69	
Delegate duties	1.70	
Listen effectively	1.76	
Adapt to situation	1.78	
Resolve conflict	1.90	
Facilitate group interaction	1.96	

[a] 1=strongly believe, 2=moderately believe, 3=neutral, 4=moderately disbelieve, 5=strongly disbelieve

Table 5. Job getting/keeping competencies in a traditional classroom

Statement	Mean[a]	Mean Average
		1.67
Work w/in guidelines	1.52	
Follow rules	1.54	
Complete required forms	1.54	
Practice punctuality	1.58	
Take responsibility	1.58	
Personal hygiene	1.60	
Express thoughts	1.61	
Exhibit dependability	1.63	
Personal interaction	1.63	
Ask for help	1.63	
Produce quality work	1.64	
Respect property	1.64	
Identify requirements	1.64	
Comply with rules	1.67	
Evaluate job offer	1.73	
Accept differences	1.79	
Clean work area	1.79	
Manage time	1.81	
Accept supervision	1.81	
Demonstrate flexibility	1.88	
Utilize equipment	1.91	

[a] 1=strongly believe, 2=moderately believe, 3=neutral, 4=moderately disbelieve, 5=strongly disbelieve

Table 6. Entrepreneurship competencies in a traditional classroom

Statement	Mean[a]	Mean Average
		1.91
Business ownership	1.75	
Business plan	1.88	
Identify finances	1.94	
Technical assistance	1.99	
Recognize issues	2.01	

[a] 1=strongly believe, 2=moderately believe, 3=neutral, 4=moderately disbelieve, 5=strongly disbelieve

Table 7. Leadership competencies in an interactive distance learning classroom

Statement	Mean[a]	Mean Average
		2.09
Follow directions	1.79	
Define goals/strategies	1.82	
Prioritize tasks	1.90	
Listen effectively	1.94	
Speak effectively	2.03	
Work effectively	2.09	
Utilize time	2.12	
Delegate duties	2.13	
Facilitate interaction	2.13	
Lead a discussion	2.21	
Organize an event	2.22	
Adapt to situation	2.24	
Resolve conflict	2.54	

[a] 1=strongly believe, 2=believe, 3=don't believe, 4=strongly disbelieve

Table 8. Job getting/keeping competencies in an interactive distance learning classroom

Statement	Mean[a]	Mean Average
		2.10
Identify requirements	1.70	
Complete required forms	1.88	
Work w/in guidelines	1.93	
Express thoughts	1.94	
Evaluate job offer	1.94	
Personal interaction	2.00	
Follow rules	2.00	
Practice punctuality	2.04	
Manage time	2.06	
Produce quality work	2.07	
Exhibit dependability	2.09	
Ask for help	2.12	
Take responsibility	2.13	
Respect property	2.22	
Comply with rules	2.22	
Accept differences	2.25	
Demonstrate flexibility	2.27	
Accept supervision	2.28	
Clean work area	2.28	
Personal hygiene	2.45	

[a] 1=strongly believe, 2=believe, 3=don't believe, 4=strongly believe

Table 9. Entrepreneurship competencies in an interactive distance learning classroom

Statement	Mean[a]	Mean Average
		1.82
Business ownership	1.73	
Identify finances	1.81	
Business plan	1.82	
Technical assistance	1.85	
Recognize issues	1.91	

[a] 1=strongly believe, 2=believe, 3=don't believe, 4=strongly disbelieve

vocational class equipped as a traditional classroom. A traditional classroom was defined as an environment without distance education technology. The core competencies were grouped into three major categories: Leadership (13), Job Getting/Keeping (21) and Entrepreneurship (5).

Item means are indicated for each competency listed in Tables 4, 5, and 6. The means ranged from 1.25 to 2.01 for all of the listed competencies. A mean average score was computed for each of the three areas: Leadership (1.67), Job Getting/Keeping (1.67), and Entrepreneurship (1.91). The item means and the mean average scores show that teachers do believe that the core competencies can be taught across the vocational disciplines in a core curriculum to a mixed vocational class in a traditional classroom.

Core Competencies in Interactive Distance Education Classrooms

Core competencies found in the Iowa Department of Education vocational education program management guide were repeated in Part II of the questionnaire. This time, teachers were asked to indicate their beliefs, from strongly believe (1) to strongly disbelieve (5), as to whether the core competencies could be taught across vocational disciplines as a core curriculum to a mixed vocational class via the teleteaching network in an interactive distance education classroom with one or two remote sites. An interactive distance learning classroom was defined as one meeting the standards established by the Iowa Communications Network and the Iowa Department of Education. Again, the core competencies were grouped into three major categories: Leadership (13), Job Getting/Keeping (21) and Entrepreneurship (5).

Item means are indicated for each competency listed in Tables 7, 8, and 9. The means ranged from 1.70 to 2.45 for all of the listed competencies. A mean average score was computed for each of the three areas: Leadership (2.09), Job Getting/Keeping (2.10), and Entrepreneurship (1.82). The item means and the mean average scores show that teachers also believe that the core competencies can be taught across the vocational disciplines in a core curriculum to a mixed vocational class in a distance education setting with no more than two remote sites.

Summary and Conclusions

The purpose of this study was to assess the attitudes of Iowa vocational teachers toward using interactive distance education strategies to support the competency based curriculum reform efforts mandated by the Federal and Iowa Departments of Education. This study addressed three of the four identified priority areas listed in the TEA request for research grants. Specifically, it addresses distance education in Iowa, the Iowa Communications Network, and the Iowa Distance Education Alliance--Iowa's Star School Project.

This study was descriptive in nature. It involved the use of a mailed questionnaire. The questionnaire was developed by the researchers after a review of the literature. The questionnaire was reviewed by a panel of experts and pilot tested with university graduate students. The population for the study consisted of all secondary vocational teachers in Iowa as defined by the Iowa Department of Education in March, 1994. A total of 300 teachers was selected: 29 agricultural education, 14 marketing education, 64 home economics education, 90 industrial education, and 104 business/office education. A total of 67 usable responses were returned to the researchers. All were certified vocational teachers and every vocational discipline was represented.

From an analysis of the data, the following conclusions are offered for consideration in furthering vocational education curriculum reforms that include the use of the ICN as a part of distance education practices:

- At the time of study, very few respondents had received any formal or informal training on using interactive teleteaching technology.

- The majority of the respondents preferred improving their knowledge and skills as a part of a formal program in a group setting as opposed to individual study.

- Respondents' knowledge of interactive teleteaching technology and reform in vocational education is severely limited.

- Respondents' ability to perform their teaching role in an interactive distance education environment is limited.

- Respondents showed a strong interest in using prepared teleteaching materials.

- Respondents strongly believed core competencies could be taught across disciplines in a traditional classroom.

- Respondents believed core competencies could be taught across disciplines in an interactive distance education environment.

From the results of this study it is apparent vocational educators desperately need more information to further curriculum reform efforts related to an interactive distance education learning environment and are most willing to use teleteaching technology. Cross-disciplinary efforts can be realized through the teaching of core competencies in a distance education environment.

Reference

Iowa Department of Education. Highlights of S.F. 449. September, 1989.

The Iowa Communications Network as a Vehicle for the Delivery of Applied Instrumental Music Instruction

Donald Simonson
Iowa State University

Each fall more than 12,000 Iowa high school musicians begin their preparations for the annual All-State Music Festival. The auditions, held usually in late October, reduce the ever increasing number of would be All-Staters to a nearly manageable 1,200 performers; 600 in the chorus, and 300 each in the band and orchestra. For over one half of the students assistance is only as far away as their choral or instrumental director. For the remainder, those who play instruments that their directors are only passingly familiar with, if at all, help is much further afield. Those students are often left to fend for themselves to gain the necessary expert instruction on their particular instrument. For those living within one of the state's metropolitan centers or near a college or university, expert teachers are easily available, although costly. For the remainder, the vast majority in largely rural Iowa, access is a practical impossibility, and their opportunity to develop the necessary musical and technical proficiencies is severely curtailed.

For many years the music faculty of Iowa State University (ISU) has, as part of its Land-Grant mission, worked to provide access and assistance to those talented and deserving students and their directors. Initially, ISU's assistance took the form of on site masterclasses and clinics. While effective in addressing the needs of the students, on site activities were exceptionally time intensive, requiring release time for travel, and were often difficult to coordinate to bring sufficient student numbers to a central site to reach critical mass. Consequently, the demand for masterclasses and clinics easily outstripped our faculty's available time. To supplement the masterclasses and clinics the department began producing and distributing audio tapes containing the required All-State etudes or exercises for each instrument as performed by ISU faculty. The audio tapes provided examples of proper performance of audition etudes for students to use as a guide and reference point for their own preparation. Again, the methodology proved effective as far as it went, but it fell short in addressing each student's unique needs, and aspects of individual application.

With the advent of the Iowa Communications Network (ICN), the state owned fiber optic transmission system linking, ultimately, every school district in Iowa, an answer to the shortcomings of the previously employed methods seemed at hand.

The ICN is real-time, two-way fully interactive audio and video capable. Because each classroom connected to the system must meet specific equipment requirements we were assured of a relatively high standard of transmission quality. Whether this quality standard was sufficient for the subtleties musical nuance remained to be seen. A number of more practical concerns required our attention first.

Our first concern, that of who where we trying to reach, was easily addressed--Iowa high school students auditioning for All-State. Next we needed to determine which instruments for which we would offer masterclasses. To test the functional range of the delivery system we wanted to employ a variety of instrumental timbres, intensities, and frequency ranges. We finally settled on Clarinet (higher harmonics, low to mid-level of intensities, mid-high frequency range), Trombone (lower harmonics, mid to high-intensity, low to mid-frequency), and Percussion (including the Timpani, Marimba, Snare Drum, Cymbal, and Tambourine, and encompassing the extremes of timbre, intensity and frequency range). Our last concern, when to offer the masterclasses, was dictated to us by the All-State schedule, and the availability of faculty members and the University's ICN classroom as an origination site. The following schedule resulted:

Trombone Masterclass,
10/12/93, 2:30-4:00 PM
Dr. David Stuart, Assoc. Prof. of Trombone

Clarinet Masterclass,
10/13/93, 2:30-4:00 PM
Dr. Joseph Messenger, Prof. of Clarinet

Percussion Masterclass,
10/14/93, 2:30-4:00 PM
Dr. Barry Larkin, Assist. Prof. of Percussion

To reach our target audience and inform them of the availability of our masterclass series, all instrumental music directors (both band and orchestra) in those cities with a fully functional ICN drop site were faxed a letter of explanation and a Masterclass Registration Form. At that time (mid-September 1993), forty-four sites were reported to be fully functional, providing a list of seventy-seven secondary school music programs with access. The Registration Form requested each director to inform us which masterclass sessions they wished to participate in and the names of those participants (including administrators, faculty and students). They were also requested to contact their districts ICN coordinator or Star Schools representative and reserve their ICN classroom for the appropriate days and hours. Each director was asked to then return the completed registration form as soon as possible, and not later than 11/04/93. It was at this point that the reality of our efforts became much more exciting.

In less than twenty-four hours the registrations were being returned, and directors were calling to request further information. Within forty-eight hours Iowa Public Television (IPTV) was calling to inquire as to what we were up to (the origination and access to any ICN transmission is programmed at the Iowa Public Television Studios in Johnston, a suburb of Des Moines). It seems that ICN coordinators from interested sites were calling IPTV to arrange to receive the transmission instead of returning their Registration Forms as requested and leaving those arrangements to us. At first blush it seemed that we had created our own little Iowa cyclone of confusion, but owing to the fact that this was the first undertaking of its kind we realized that everyone's confusion was the result of a lack of experience, and was just part of "working out the bugs". In any case, in short order our efforts were coordinated and we got down to the business of final transmission preparations.

On the Friday prior to the first masterclass a tour of ISU's ICN classroom was arranged for the three faculty presenters. Their major concerns focused on the 'how to' of the system. Through the guidance of Matt Darbyshire and his assistants their fears were assuaged and the discussion moved on to the mundane issues of where they should stand, where their music stands should be placed, and the like. The final concern was that of the musical fidelity of the transmission. The staff had informed us that the audio portion of the signal was compressed and that dynamic variations could possibly be compromised given the systems technical and hardware limitations (the microphones were designed primarily for speech transmission and the speakers in the video monitors were not of stereo or hi-fi specification). While this particular aspect was one of great concern the masterclass presenters seemed challenged to overcome any negative effect.

As the transmission of our first masterclass approached, Dr. David Stuart, the Trombone teacher busied himself with last minute details. Dr. Stuart, an active guest clinician and performing professional musician, felt an informal approach would be most conducive to the creation of an atmosphere in which faculty and students alike would feel comfortable while confronting a new technology. Within minutes of beginning his presentation the over thirty students and faculty participating in his masterclass were freely communicating like old pros at two-way interactive television. Stuart, controlling the topics and direction of the masterclass, moved easily between lecture and demonstration. Three area trombone students also served as guinea pigs demonstrating the required All-State etudes and scales. Questions from the receiving sites flowed freely and before long, Stuart, as well as the remote sites were listening to a student try her hand at a mock All-State Audition. More questions and demonstrations followed and before we knew it our reserved time was up and we had to sign-off. In a brief informal post-masterclass meeting including all of the faculty and production staff, we reviewed the experience in an attempt to fine-tune the process before the next masterclass of the series. To our surprise we agreed that it had been remarkably smooth and that even our concern over the quality of the audio signal was, for now, a non-issue. Returning to my office about an hour later I was pleased to find two messages on my answering machine from directors who had just participated in the Trombone masterclass. Both could hardly contain their excitement over the quality of their student's and their own first experience with this new distance education technology.

The Clarinet masterclass followed very much the same format as the Trombone session with the addition of another 40 participants and extending the transmission of our signal from the Missouri river on the western border of Iowa to within 30 miles of the Mississippi (from Sioux City in the west to Maquoketa in the east). While Dr. Messenger's style differed from Dr. Stuart's in matters of presentation his expertise came across easily. Again the concern over the audio transmission proved insignificant and, in fact, it seemed that as the session progressed the quality of the audio signal improved. This was doubtless a psycho-acoustic adjustment of the hearing mechanism and a reaffirmation of the adaptability of the human mechanism to its environment.

As the session progressed, Dr. Messenger's teaching became more and more detailed and subtle in its focus. The questions dealt to a greater degree with issues of minute nuance. As student after student performed for Dr. Messenger and each other over the ICN, a true appreciation of the ICN's potential became evident. Not only was it possible for Dr. Messenger to teach at a level of individual subtlety here-to-for unknown outside of the music studio, he was able to use each student's unique skills and talents, as well as their shortcomings, to affect a learning synthesis unique to group interaction. All this with the individuals scattered across an incredibly large geographic area. In another post-masterclass briefing the verdict was unanimously positive. Comments from participants continue to overwhelmingly support that conclusion.

The last session of our masterclass series proved to be, as was expected, the most thorough test of the technology. It also required the greatest amount of preparation with respect to props, equipment and stage setting. While a trombone can be an unwieldy instrument, its space requirements can be easily accommodated in even the most confining of rooms. On the other hand, three Timpani, a Marimba, a Snare Drum and various other percussion instruments, mallets, sticks and music stands requires a tremendous amount of space. To cover this large space the camera angles needed to be readjusted, and special moveable microphones had to be employed. With ISU's flexible and capable technical staff the necessary physical adjustments were easily accomplished. Because the receiving sites needed the same variety of instruments for student participation a somewhat smaller registration was expected. Our registration included six sites with a total of 21 faculty and student participants. Dr. Barry Larkin, the presenting percussionist, wanted to encourage as much participation and interaction as possible. With the first distant site performance the audio signal finally became the concern we had feared. As soon as the student from Maquoketa began to play the Timpani the audio quality deteriorated to a raucous, indistinguishable rumble. After a quick consultation with the staff a possible technical solution to the problem was offered. **Try moving the microphone further away from the Timpani!** With two attempts the perfect distance was achieved and the audio quality was re-established. This pattern was repeated for nearly each change of site and each change of instrument. While definitely low-tech, it was a functional solution to the problem. As was the case in the previous sessions Dr. Larkin was able to address issues of surprising subtlety and in doing so effect a remarkable amount of positive change. Unique to the Percussion masterclass was the manner with which Dr. Larkin relied on the visual image as a diagnostic aid for discerning poor or potentially harmful muscular function in the participating students. Working with the subtleties of grip tension and wrist flexibility Dr. Larkin made immediate and easily recognizable changes in the participating students' performance. These changes were noticed not only by the faculty members but also by the students, again providing the raw material for synthesis and learning.

Having completed our series of masterclasses, the process of evaluating the effectiveness of the ICN as a delivery system for teaching applied instrumental music remained. The evaluation process consisted of a brief follow-up survey which was distributed to each of the participating instrumental music directors and clinicians (see below). Of the seventeen participants, fifteen responded and completed the survey. The responses (in parentheses and emboldened below) are noted below.

The survey responses, in being overwhelmingly positive, affirm the effectiveness of the ICN as a delivery system for applied music instruction. Those participating school music teachers are convinced that the ICN can positively affect and impact the performance of their instrumental music students. The ISU faculty clinicians are also convinced of the ICN's potential as an educational aid. In fact, at the present time plans are being developed to offer a series of masterclasses for instrumental and vocal students preparing for Iowa's spring solo music contests. In addition, a number of music faculty are investigating possible continuing education workshops or classes directed to the needs of public school music teachers. In short, a negative word has yet to be spoken about the ICN. From the musicians point of view, it is a technology to be embraced, explored and exploited to increase and broaden the impact and reach of our art.

TEA-IDEA ICN
Masterclass Survey

1. Before your ICN Masterclass experience, had you thought that teaching applied music was a possible use for the ICN?

   yes **(7)** no **(8)**

2. If you answered 1. no, why?

   Wasn't aware of the technology **(2).**
   Assumed the ICN wasn't suitable for music transmission.
   Thought of the ICN as a visual medium not an aural medium.
   Thought of the ICN as a classroom, lecture type system.
   Just didn't think of it. **(2)**
   No reason or response given.

3. What did you believe would be the greatest shortcomings of applied instruction over the ICN?

a.	Sound Quality	**(8)**
b.	Video Quality	**(0)**
c.	Ease of use	**(6)**
d.	Classroom/student management	**(2)**
e.	Interactivity	**(4)**
f.	Other (specify)	

   Expected system glitches and bugs common to new technology.

4. What were the greatest shortcomings of applied instruction over the ICN?

a.	Sound Quality	**(5)**
b.	Video Quality	**(0)**
c.	Ease of use	**(2)**
d.	Classroom/student management	**(0)**
e.	Interactivity	**(1)**
f.	Other (specify)	

   Lack of access to ICN classroom **(3).**
   Local ICN site used as a regular classroom, and in use.
   Assumed no shortcomings **(4)**

5. What did you believe would be the greatest benefits of applied instruction over the ICN?

a.	Access to experts	**(11)**
b.	Interactivity	**(5)**
c.	Ease of use	**(2)**
d.	Low cost	**(1)**
e.	Potential for increased input	**(7)**
f.	Other	

   Didn't know what to expect.

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6. What were the greatest benefits of applied instruction over the ICN?

a. Access to experts **(13)**
b. Interactivity **(6)**
c. Ease of use **(5)**
d. Low cost **(2)**
e. Potential for increased input **(8)**
f. Other
Ability to access other participating sites.

7. Please rate the following on a scale of 1 to 5, with 1 the lowest and 5 the highest.

a. Speech sound quality **(Mean Score)**

1 2 3 4 5 **(4.2)**
low quality average quality high quality

b. Music sound quality

1 2 3 4 5 **(3.9)**
low quality average quality high quality

c. Overall sound quality

1 2 3 4 5 **(4.1)**
low quality average quality high quality

d. Video quality of media and music

1 2 3 4 5 **(4.7)**
low quality average quality high quality

e. Video quality of instructor/student performances

1 2 3 4 5 **(4.8)**
low quality average quality high quality

f. Overall video quality

1 2 3 4 5 **(4.8)**
low quality average quality high quality

g. Ease of use as a passive participant

1 2 3 4 5 **(4.3)**
difficult average ease very easy

h. Ease of use as an active participant

1 2 3 4 5 **(4.7)**
difficult average ease very easy

i. Overall ease of use

1	2	3	4	5	**(4.5)**
difficult		average ease		very easy	

8. Compared to other forms of distance education delivery, how would you rank the ICN ? (scale of 1 to 5, 1 lowest-5 highest).

1	2	3	4	5	**(4.7)**
not effective		average effectiveness	highly effective		

9. What was your expectation of the effectiveness of applied music instruction over the ICN?

1	2	3	4	5	**(3.7)**
not effective		somewhat effective		very effective	

10. Based on your experience with the All-State Masterclass Series, how effective is applied music instruction over the ICN?

1	2	3	4	5	**(4.6)**
not effective		somewhat effective		very effective	

11. How likely are you to participate in future ICN applied music masterclasses?

1	2	3	4	5	**(5.0)**
not likely		somewhat likely	very likely		

Figures

Iowa Communications Network (ICN)

Part 1 and Part 2

— Part 1 Link

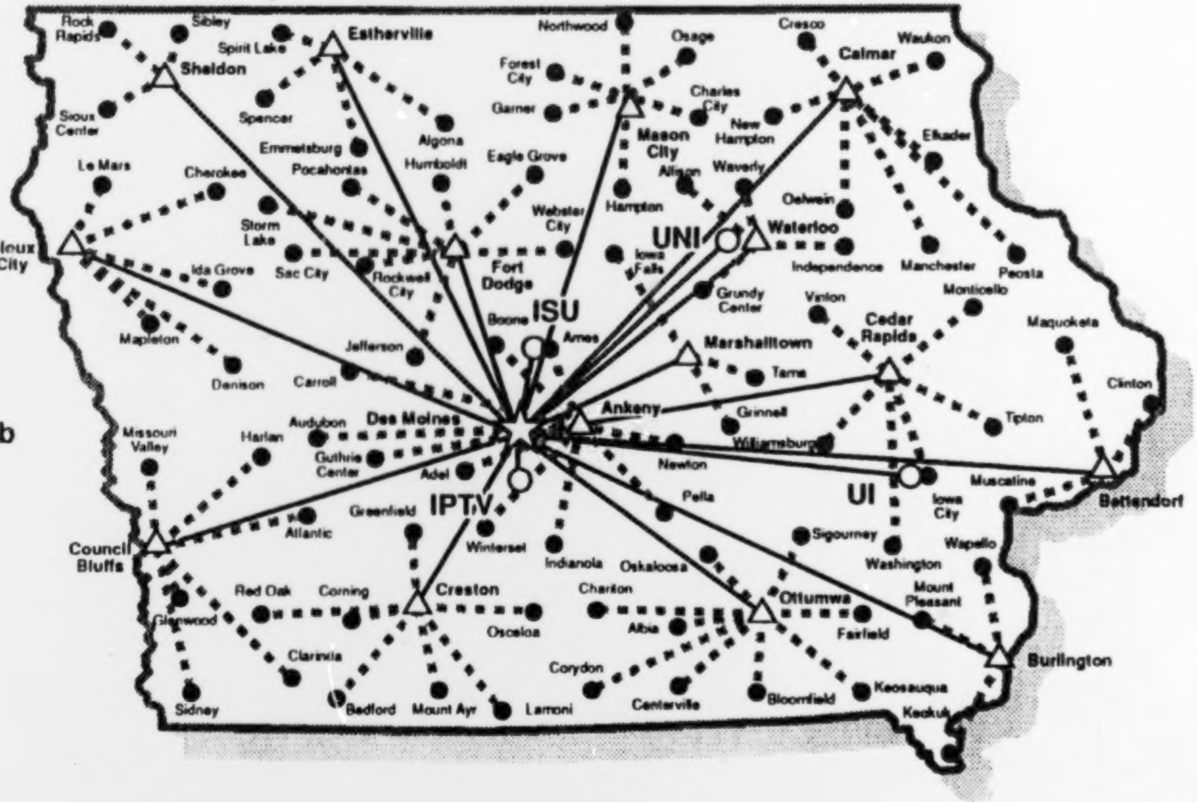
- - - Part 2 Link

☆ Camp Dodge Hub

△ Regional Center

● Part 2 Site

○ Direct Hub Link



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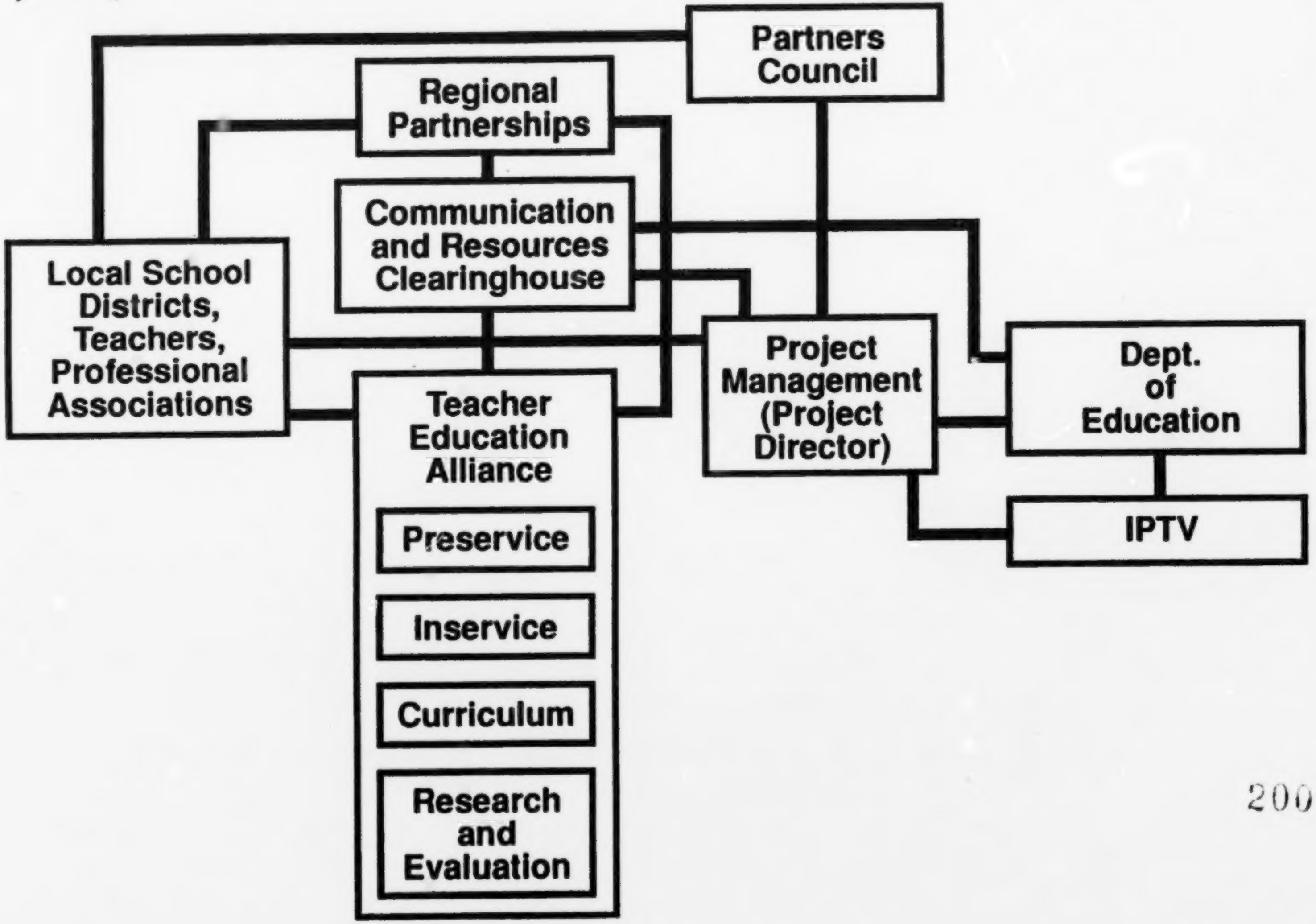
Organization Plan



Partners Council

Regional Partnerships

Communication and Resources Clearinghouse

Local School Districts, Teachers, Professional Associations

Teacher Education Alliance

- Preservice
- Inservice
- Curriculum
- Research and Evaluation

Project Management (Project Director)

Dept. of Education

IPTV

Goals

Goal 1: DE in Iowa using the ICN will be conducted in a COORDINATED and systematic manner.

Goal 2: Instruction using the ICN will be UNDERSTOOD and ACCEPTED by Iowans.

Goal 3: Iowa educators will be PREPARED and SUPPORTED so they can effectively teach students at a distance.

Goal 4: Iowa schools will be CONNECTED to the ICN and through it to other telecommunications networks.

Goal 5: Instruction in mathematics, science, foreign languages, literacy skills, and vocational education will be IMPROVED and the number of opportunities will be INCREASED.

Goal 6: A program of RESEARCH and EVALUATION will be established to document the impact and effectiveness of the use of the ICN.